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OUTLINES

OF THE

ANATOMY

OF THE

HUMAN BODY,

IN ITS SOUND AND DISEASED STATE.

BY

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M. D. F. R. S. E.,

AND MEMBER OF THE ROYAL COLLEGE OF SURGEONS:

THIS TRIBUTE

OF GRATITUDE AND SINCERE REGARD,

IS RESPECTFULLY PRESENTED

BY THE

AUTHOR.

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OUTLINES

OF THE

ANATOMY OF THE HUMAN BODY.

CHAPTER I.

OF THE ORGANS OF URINE.

SECT. I.

OF THE KIDNEYS.

THE kidneys are not contained within the cavity of the abdomen.

They are situated at the sides of the spine, imbedded in a large quantity of fat of a peculiar structure, which is lodged in a loose cellular texture.

The kidneys lie over the diaphragm, the large psoæ and quadrati lumborum muscles, and over the 10th, 11th, and 12th ribs, and approach nearly to the crista of the os ilium.

On account of the difference in the bulk of the liver and spleen, which are situated in the im-

mediate vicinity of the kidneys, the right kidney is placed rather lower than the left one.

The kidneys are about five or six inches long, and in figure resemble the kidney bean, and with the concavity inwards, they are elongated from above downwards, convex outwardly, and broader in the upper end, to which a gland of a very particular nature, called the *renal gland*, is connected, the concave basis of which is turned towards the kidney.

The kidneys are retained in their situation by ligaments, which are formed by a reflection of the peritoneum. The peritoneum passing from the right kidney to the liver, is called the *right ligament*, and on the left side the peritoneum goes to the spleen, and is called the *ligament of the left kidney*.

The section of the kidney exhibits two different substances, viz. a cortical vascular part, and the tubular uriniferous, and a series of conical shaped bodies, which hang into the infundibula or calices, and the cavity called *pelvis*.

The *cortical part* is externally smooth; of a pale red colour, and intimately connected to the proper membrane of the kidney; is three or four lines in thickness; and it sends in processes which fill up the intervals between the tubular uriniferous part.

On tearing the cortical part, small grains are felt in it, or seen after throwing a penetrating injection into the renal arteries; thence called *acini* of the kidney *.

* Vid. Plate XXXVI.

The *tubular part* is of a lighter colour than the cortical, more dense, composed of small tubes united to each other.

The fasciculi of urinary tubes are collected into conical-shaped bodies, called *papillæ;* upon the sides and extremities of which there are visible openings through which the urine distills *.

A penetrating injection sometimes imitates the secretion of urine; that is, it passes from the renal artery into the uriniferous tubes, which seems to prove a continuity of the vessels.

The infundibula are less numerous than the papillæ, as in some instances one infundibulum is common to two papillæ.

The smaller infundibula are united into three large trunks, which come from the upper, middle, and lower parts of the kidney, and these form the cavity of the kidney, called *pelvis.*

The pelvis of the kidney, which is in its middle most capacious, is placed between the large branches of the renal artery and vein.

The membrane of the pelvis is white, firm, but loose, and is lined by a mucous membrane.

Each kidney is supplied by one or more arteries, called *renal,* which are sent off at a right angle from the aorta, and are of great size in proportion to the bulk of the kidneys.

The renal veins lead into the vena cava inferior.

* Vide the magnified figure of one of the Papillæ, Plate XXXVI.

The nerves of the kidneys are derived from the sympathetic nerves.

Renal Glands.

The renal glands are of a yellow colour; somewhat of a triangular form; about two inches long; and surrounded by cellular substance; and adhere to the upper and fore parts of the kidneys.

These glands are sometimes filled by a bilious-looking fluid.

Of the Ureter.

The tube by which the urine flows from the kidney to the bladder of urine, is called *ureter*.

The ureter arises from the inner and lower part of the pelvis or kidney, by its infundibulum. This tube is not cylindrical, but contracted where it passes over the brim of the pelvis, and between the coats of the bladder. Generally there is only one to each kidney, but I have seen two on one side.

The spermatic vessels cross over the ureters, opposite to the sacro-iliac symphysis; then the ureter crosses the common iliac artery and vein. At the base of the os sacrum, the ureters pass downwards, forwards, and inwards, and towards the under surface of the bladder, where they cross the vasa deferentia, and then enter the bladder obliquely, between the muscular and mucous coats, and open by a narrow orifice at the posterior angle of the triangular space near the neck of the bladder.

Explanation of Plate 36th.

Fig. 1. represents a mould of the pelvis of the kidney, and also points out the relative situation of the renal artery in respect to it.

The figure immediately opposite to figure 1st, represents one of the papillæ, much magnified.

The other figures represent the ramifications of the renal artery, of their natural size, and also much magnified.

The oval-shaped bodies appended to the arteries, my Father discovered, to be composed solely of a plexus of very minute arteries.

SECT. II.

OF THE BLADDER OF URINE.

THE bladder of urine is a musculo-membranous organ, which occupies the anterior part of the pelvis; it is placed immediately behind the ossa pubis, to which it is connected by cellular substance and by ligaments.

It is connected to the rectum in the male, and womb in the female, by the reflected peritoneum.

Of the Size and Figure of the Bladder of Urine.

The size and figure of the bladder of urine are various at different periods of life, and in the different sexes.

The bladder of infants is proportionally larger than in adults.

In consequence of continued distention, the bladder acquires a larger size in women who lead a sedentary life, or who live much in society, and are in the habit of retaining their urine for a long time: it becomes not only longer, but also much broader, and generally, as CELSUS has observed, inclines to one side.

The figure of the bladder varies no less than its size. The bladder of the fœtus is in figure like a pear, and its length is nearly three times greater than its transverse diameter, and a small part only of it is contained within the pelvis; for the fundus vesicæ ascends very near to the umbilicus.

The anterior part of it is not covered by the peritoneum; so that at this period of life it is possible, when the bladder is only half-full, to make an opening into it above the ossa pubis.

The upper aperture of the pelvis of the fœtus is so small, that the rectum distended by the meconium, almost fills the whole pelvis. When a child is three or four years old, the pelvis has generally attained such a size as to admit the bladder.

Of the Figure of the Bladder in the Adult.

The bladder of the adult is much shorter in proportion than in the fœtus in its undistended

state, and it is contained within the cavity of the pelvis, unless when much distended.

Of the Bladder when Undistended.

The bladder, when undistended, has somewhat of a triangular figure; the fundus of it is directed towards the urachus, is nearly on a level with the symphysis pubis, and rests upon the rectum of the male, and vagina of the female.

When the bladder is very much contracted, as in persons who have suffered a violent death, the figure of the bladder is somewhat rounded, and situated lower down in the pelvis.

In the contracted state of the bladder, the peritoneum is loose between the bladder and rectum; and in this state of the bladder, the rectum forms a considerable projection inwards upon the bladder; and in women, it is more obvious, as the vagina adds to the bulk. Thus the bladder is divided into two lateral projections, in which calculi are frequently lodged; and in women, who have had several children, these lateral projections of the bladder become still more manifest.

The cellular substance around the bladder is very loose, and especially that between it and the superior part of the symphysis pubis; whereas that between the rectum and bladder is more dense and less capable of dilatation.

Of the Bladder of the Adult, when Distended.

In order to form an accurate opinion of the figure of the bladder, it is necessary to fix the attention, first, upon its anterior; then upon its posterior; and, lastly, upon its lateral portions.

Upon the bladder being distended, that part of the body of it which lies upon the rectum, in the first place, changes its figure; the fundus ascends towards the umbilicus; the bladder almost fills the cavity of the pelvis; the anterior part of it presses upon the ossa pubis; the lateral portions are rounded, and the posterior presses upon the rectum.

Should the bladder be still further dilated, its body inclines over the symphysis pubis, and forms a manifest tumour above the pubes; and in consequence of the cellular substance which connects the bladder to the ossa pubis, stretching it, it does not press much upon the rectum; and in such a distended state, the inferior and anterior part of the bladder is in immediate contact with the abdominal muscles.

The inferior part of the bladder is somewhat of an oval form; and the breadth from one side to the other is rather greater than from the fore to the back part.

The urethra in the adult does not take its rise from the lowest part of the bladder: about the

breadth of a finger, or a finger and a half, intervenes between the beginning of the urethra and the lowest part of the bladder.

In the healthy state, a space, equal to two or three inches, intervenes between that part of the bladder which is covered by the peritoneum, and the ossa pubis. In some cases, the bladder rises much higher. I visited a man, whose bladder was then as high as the navel; and I was informed, that a little before, it had been still higher, and that 12 lbs. of urine had been drawn off from it.

It sometimes, though very rarely happens, that the peritoneum is attached obliquely in respect to the bladder.

The posterior part is more expanded, and bounded by a kind of cul de sac, which covers part of the vesiculæ seminales, and vasa deferentia; and between the vesiculæ, the bladder is in contact with the rectum, and connected to it by loose cellular substance, in which many veins are lodged.

The internal surface of the bladder is smooth, when that organ is distended and besmeared by mucus.

There is a part of the inner surface of the bladder, which has been called *trigone*; it is rather whiter than the rest of the bladder, and bounded before by the urethra, and laterally by the openings of the ureters.

Of the Ligaments of the Bladder.

There are two ligaments proper to the bladder, which extend from the symphysis pubis, to the upper part of the neck of the bladder, and to the prostate gland.

The upper ligament of the bladder is composed of the umbilical arteries, urachus, and of the reflected peritoneum.

The urachus of the adult appears fibrous, of a white colour, and extends from the bladder to the umbilicus, where it is lost, becoming insensibly of a very small size.

It is generally solid, sometimes hollow; and it is said by Littre, that the urine sometimes passes through it, and escapes at the navel, which only happens when the neck of the bladder has been obstructed.

Haller informs us, that the urachus, as it passes along the umbilical chord, may be filled with mercury, for an inch and a-half.

It then divides into a number of filaments, which are lost upon the umbilical arteries.

The urachus of quadrupeds passes along the chord to the allantois.

The under ligament of the bladder of urine, extends from each side of the neck of the bladder and prostate gland, and is fixed to the inner side of the symphysis pubis.

Of the Coats of the Bladder of Urine.

Four coats are commonly said to be proper to the bladder, viz. a membranous coat, which is derived from the peritoneum, a muscular coat, a cellular coat, and an internal mucous coat.

The *peritoneum* covers only the upper and back part of the bladder of the adult.

The external surface of this coat is besmeared by a quantity of a serous fluid.

Its internal surface adheres to the muscular coat, by means of very loose cellular membranes.

This cellular membrane has not the same thickness, or even appearance, in every part of the bladder. In the anterior and lateral regions, the cellular substance is lax, and there is a considerable quantity of fat intermixed with it.

Around the vesiculæ seminales, we find a dense cellular substance of a whiter colour.

The cellular substance has been stated to add considerably to the strength of the bladder; for when it is dissected off, the internal coat is protruded betwixt the muscular fibres.

The *muscular fibres* of the bladder, in the healthy state, are of a pale colour, and but of a small size, and disposed in fasciculi, which cross each other in every possible direction, and completely surround the bladder.

Some of these muscular fasciculi follow a longi-

tudinal direction, a few a circular, and most of them an oblique course.

The muscular fibres of the bladder of the fœtus are proportionally thicker than those of the adult.

The bladder of a child is more irritable and more powerful; and the urine can then be discharged to a greater distance than in advanced life.

The longitudinal fibres form the external stratum.

The oblique and circular fibres are placed beneath the longitudinal; but these fibres are so much intermixed with the other fibres of the bladder, as to render it very difficult to follow out any one packet of fibres.

Some of the muscular fasciculi of the bladder, in some instances, contract to a great degree, so that the bladder is divided, like a sand-glass, into two cavities.

The *cellular coat* of the bladder, is of a white colour, and readily dilated.

The *innermost coat* of the bladder, when distended, is perfectly smooth, and is besmeared by a quantity of mucus.

The follicles which secrete the mucus have been said to be apparent in the catarrhus of the bladder; but I must confess that I never have been able to observe them.

The urine is expelled by the joint contraction of the detrusor urinæ, and the muscles of respiration; the muscular fibres around the neck of the bladder being at the same instant relaxed.

Sect. III.

OF THE URETHRA.

There is a great difference as to the length of the male and female urethra.

Of the Urethra of the Male.

The urethra extends from the bladder to the extremity of the penis; it is about nine inches long; dilatable; not of an uniform diameter; and surrounded in part by a plexus of veins; and lined by a very dilatable mucous membrane; in the greater part of which there are longitudinal folds, and upon which a considerable quantity of mucus is poured by forty or fifty orifices, which open upon its surface from behind forwards, but which are not connected with any distinct glandular apparatus. The urethra is very elastic, admitting at one moment a large bougie to be passed, and then contracting upon a thread. This canal does not describe a straight course; it passes downwards and forwards for about an inch, where it is surrounded by the prostate gland; it then passes under the symphysis pubis, and ascends between the crura penis, and is connected to the rectum. This portion, which extends between the prostate gland, and bulb of the urethra, is about an inch long, and has been named the *membranous part* of the urethra, being covered by a membrane, a dense cellular substance, and a thin stratum of muscular fibres,

which Mr WILSON has described, and which arise by a double tendon from the arch of the pubes, and which unite under this part of the canal *.

The urethra is then inclosed in its corpus spongiosum, which is made up of a plexus of blood-vessels.

This spongy substance, which is covered by the same cellular sheath as the corpora cavernosa penis, begins in the form of a conical-shaped process, the apex of which passes obliquely downwards in the direction of the perineum between the crura penis, and it is covered below and at its sides by the accelerator urinæ; and it is connected to the arch of the pubes by a strong triangular-shaped ligament.

The urethra is then firmly fixed to the corpora cavernosa, along which it passes; and having passed through the glans, it terminates in a vertical aperture.

The diameter of the urethra is by no means uniform; it is largest where it passes through the prostate gland, the bulb of the urethra, and the glans.

Mr HOME has been at great pains in taking moulds of the male urethra, and has published the following measurements †.

* Vide Medico-Chirurg. Transact. of London, vol. i.

† To determine with precision the length as well as width of the urethra, exact casts of it were taken in wax, stretching it in the dead body as much as it would readily bear; in this way a bougie was formed of the size of the urethra. The subjects from which these casts were taken were of different ages, one

Of the Glans Penis *.

The glans penis is a conical-shaped body, and surrounded by a prominent margin called the *corona glandis*.

was between 70 and 80, the other 30. In both of them the penis was of a small size, and the external orifice at the glans unusually small in the collapsed state.

The length of the canal corresponded exactly in both casts.	*Inches.*
From the external orifice to the neck of the bladder, was - - - - - -	9 †
From the external orifice to the bulb of the urethra,	7
The membranous part, extending from the bulb to the prostate gland, - - - - -	$1\frac{1}{2}$
The canal passing over the prostate gland, -	$\frac{1}{2}$

The width of the urethra varies in different parts of the canal, and is every where much larger than had been supposed, exceeding the size of the largest bougie in use in a very great degree. It will make the diameters of the urethra in its several parts more clearly understood to contrast them with those of bougies.

	Inches.
The diameter of a common sized bougie, -	$\frac{4}{20}$
Of the largest sized bougie in use, - -	$\frac{5}{20}$

The diameters of the casts of the Urethra, in different parts.	Years old. 80. 30.
At $\frac{1}{2}$ of an inch from the external orifice, -	$\frac{9}{20}$ $\frac{7}{20}$ $\frac{1}{2}$
At $4\frac{1}{2}$ inches from the external orifice, -	$\frac{7}{20}$ $\frac{7}{20}$
At the bulb of the urethra, 7 inches from the orifice,	$\frac{12}{20}$ $\frac{13}{20}$

* The same muscles expel the urine and semen, and therefore I have described them under the head of the Male Organs of Generation.

† The canal in a relaxed state is in common about $8\frac{1}{2}$ inches long.

The glans is made up chiefly of a plexus of small convoluted veins, which communicate with the corpus spongiosum urethræ, and is covered by a very fine and vascular skin, upon which there are a number of villi.

The glans is besmeared by a fluid (said to be sebaceous) which is described by Morgagni † and Haller, as being derived from hard white small bodies, situated about the corona glandis, called *glandulæ odoriferæ*.

The glans is covered by the skin which is reflected from the glans, so that it covers the glans when the penis is relaxed, and hence has been called *prepuce*; which prepuce is fixed below to the glans by means of a frænum, which prevents the over-retraction of the glans.

The penis is supplied with blood from the arteriæ pudendæ; and the veins of the penis unite, and form a large venous trunk, which passes into a plexus of veins, which lie in the vicinity of the prostate gland.

In the membranous part, directly beyond the bulb, $7\frac{1}{2}$ inches from the orifice *, - - - -	$\frac{7}{20}$	$\frac{4}{20}$
In the membranous portion near to the prostate gland, $8\frac{1}{2}$ inches from the orifice, - -	$\frac{9}{20}$	$\frac{7}{20}$
Where the membranous part terminates, and the prostate gland begins, $8\frac{1}{2}$ inches from the orifice,	$\frac{7}{20}$	$\frac{6}{20}$
In the middle space of the prostate gland, $8\frac{3}{4}$ inches from the orifice, - - - - -	$\frac{11}{20}$	$\frac{10}{20}$
At the neck of the bladder, 9 inches from the orifice	$\frac{9}{20}$	$\frac{8}{20}$

* In the man 30 years of age there had been a stricture at this part.

† Vid. his Adversaria.

Sect. V.

OF THE URINE.

Healthy urine is a transparent fluid, of a light amber colour, which emits a peculiar odour, has a slightly bitter taste, and the specific gravity of it varies, according to Cruickshanks, from 1.005 to 1.033.

The odour of urine that has been kept for two or three days, is distinctly *alkaline*.

The state of the urine depends much upon the state of the other secretions, particularly upon the quantity of sweat and perspiration; hence the quantity of the urine is various at different seasons of the year.

The state of the urine is modified by the age of the individual.

The urine of a child, whose bones are not completely ossified, contains no phosphoric acid, but a large excess of benzoic acid.

The urine of the old, is highly charged with the earthy phosphates, with the uric acid, and mucilage. Different kinds of food bring about a change in the urine, particularly when the digestive organs are weak.

Various vegetable substances, taken into the stomach, communicate their flavour and colour to the urine: rhubarb makes urine of a deep yellow colour; madder renders it red; and indigo communicates a blue tinge.

Asparagus, garlic, onions, and turpentine, give to the urine a peculiar smell.

Chemical Analysis of Urine.

The urine contains the following substances:

1. Water.
2. Acetic acid.
3. Phosphate of lime.
4. Phosphate of magnesia.
5. Carbonic acid.
6. Carbonate of lime.
7. Uric acid
8. Rosacic acid.
9. Benzoic acid.
10. Albumen.
11. Urea.
12. Resin.
13. Muriate of soda.
14. Phosphate of soda.
15. Phosphate of ammonia.
16. Muriate of ammonia.
17. Sulphur.

Healthy urine contains also occasionally other substances. Very often muriate of potash may be distinguished among the crystals, which form during its evaporation. The presence of this salt may always be detected, by dropping cautiously some tartaric acid into urine. If it contains muriate of potash,

there will precipitate a little tartar, which may easily be recognized by its properties *.

Urine sometimes also contains sulphate of lime †.

Urine rapidly putrefies, and mucilaginous flakes are deposited; the phosphoric acid is saturated with ammonia, and the phosphate of lime is precipitated.

When the urine has putrefied, which is owing to the action of the jelly on urea, it consists chiefly of the following ingredients:

1. Ammonia.
2. Carbonate of ammonia.
3. Phosphate of ammonia.
4. Phosphate of magnesia and ammonia.
5. Urate of ammonia.
6. Acetate of ammonia.
7. Benzoate of ammonia.
8. Muriate of ammonia.
9. Muriate of soda, beside precipitated jelly and phosphate of lime ‡.

* Cruickshanks, Phil. Mag. vol. ii. p. 241.

† Fourcroy, Ann. de Chim. tom. vii. p. 183

‡ Ann. de Chim. tom. 31. p. 70.

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Dr PARSONS, on the Bladder.
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Dr PEARSON, Lond. Phil. Trans.
FOURCROY and VAUQUELIN, Syst. de Con. Chim.
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PROUST, Ann. de Chim. tom. xxxi. p. 66.
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PART XVII.

OF URINARY CONCRETIONS, AND THE ORGANIC DERANGEMENTS OF THE URINARY ORGANS.

CHAPTER I.

OF URINARY CALCULI, OR URINARY CONCRETIONS.

THE word *calculus* is by no means applicable to those concretions which are occasionally formed in the urinary passages.

Urinary calculi, with the exception of those consisting of oxalate of lime and silica, are similar to the constituent parts of the urine, and are merely concretions.

These concretions are different in size, colour, figure, consistence, weight, and in their chemical ingredients.

Urinary concretions may occur in any part of the uriniferous canals, or in any place into which the urine may be effused.

The form and size of urinary concretions, generally depend upon the shape of the cavities containing them; hence those found within the pelvis of the kidney, sometimes assume an arborescent appearance, having taken a mould of the pelvis, and infundibula of the kidney; and hence calculi of the bladder are generally of a round or oval figure.

There is generally only one calculus within the bladder, and it is of an oval form, and smooth on its surface. The average weight of eighty calculi in the Museum of the University, is between two and three ounces; but sometimes they attain a much larger size and weight, ten, twelve, twenty, thirty ounces, or even more.

When there are two or more concretions within the bladder, they are generally of a small size, of a yellow or brown colour, and they impress each other more or less, and sometimes to such a degree, as to resemble a cup and ball. The state of the surface of the calculus, therefore, merits attention, as we thus distinguish whether there is only one or more calculi within the bladder of urine.

The dark-coloured moriform calculi are in general smallest, but are, in proportion to their bulk, the heaviest; whereas those of a white colour, generally acquire a larger size *.

* In the collection of urinary concretions, which Mr FOURCROY shewed me, there was a much greater proportion of large white concretions, than in any of the Museums of Britain, I have had an opportunity of examining.

The greater number of urinary concretions, when divided, exhibit a lamellated structure, and the constituent lamellæ are generally different in colour, consistence, density, and chemical composition; the external lamellæ being often thickest, porous, and of a white colour.

Very few concretions are formed upon an extraneous body. In the central part of many of them, there are evidently a number of small crystals, glued together by animal matter.

It sometimes happens, that one concretion is moveable within another, which is owing to the effusion of blood, occasioned by the irritation of the calculus, which blood shrinking, the smaller calculus is moveable within the larger.

As these concretions are formed upon the principle of crystallization, a urinary concretion may be formed, wherever there is any nucleus to attract the salts of the urine.

Urinary concretions may be divided into five classes. The *first* includes those composed of uric acid, and of urate of ammonia. Such concretions are of a brown or yellow colour, of a lamellar and radiated texture; and are soluble in alkalies. The precipitation is accomplished by acids. The precipitate is soluble in nitric acid; the solution is of a pink colour, and tinges the skin red.

The *second* class includes such, as consist of the phosphate of lime, and the phosphate of ammonia and magnesia, which are soluble in acids. Those

composed of the phosphate of lime, resemble chalk; stain the fingers or cloth; are easily broken; are to the taste insipid; and insoluble in water, but soluble in nitric or muriatic acids, from which the earth may be precipitated by ammonia or fixed alkalies.

The calculi composed of phosphate of magnesia and ammonia, are of a brilliant white appearance; consist of lamellar crystals; and their crystals assume a prismatic form. These have a sweetish taste; and are very soluble in diluted acids.

The *third* class includes those consisting of the oxalate of lime, and silica; and which are scarcely soluble in acids, or in alkalies.

Calculi composed of the oxalate of lime, are of a dark chocolate colour; very heavy; very hard; generally rough on their surface; sometimes resembling a mulberry. They seldom or never attain a large size; are insoluble in alkalies; and are very slowly dissolved in diluted acids; and when burnt, a quantity of pure lime, equal to one-third of the calculus, is left.

The *fourth* class contains concretions, which contain a proportion of muriate of ammonia.

Such calculi, when treated with water, are in part dissolved, and the remains consist of pure uric acid. The matter dissolved is composed of urea, and partly of muriate of ammonia.

The *fifth* class includes those calculi which are composed of cistic oxide. They are white, dense and brittle. 1. This substance dissolves, and com-

bines with acids and alkalies, and crystallizes with both. 2. It is precipitated from nitric acid by alkohol. 3. It does not affect the colour of vegetable blues. 4. It is insoluble in water, alkohol and ether *.

Besides the above substances, urea and animal matter enter into the composition of urinary calculi; the latter of which cements together the other ingredients.

There are very few urinary concretions which consist of only one ingredient.

Calculi sometimes fall to pieces within the urinary organs, where no particular remedy has been used.

Lastly, persons of all ages are afflicted by this disease, though not equally so; it is but rare before the third or fourth years of life; very frequent, according to the report of Mr SANCEROTTE, between the sixth and twelfth years, and also in old age.

Males are much more frequently attacked by the disease than females. According to the statement of the above author, of 1600 patients afflicted by calculus, only 65 were females, which may be readily explained from the difference in the length and diameter of the male and female urethra.

It may not be improper to add, that of 150 calculi found in the bladder, and analysed by

* ALEMANI lately has discovered a very small proportion of the phosphate of iron in a urinary concretion. Vid. Ann. de Chim. tom. lxv. p. 222.

Mr BRANDE, the following was the composition:

16 composed of uric acid.
45 uric acid, with a small relative proportion of the phosphates.
66 the phosphates, with a small proportion of uric acid.
12 the phosphates entirely.
5 uric acid, with the phosphates, and nuclei of oxalate of lime.
6 chiefly oxalate of lime.
---
150 *.

For an account of the changes which the urine undergoes in different diseases, the reader is referred to the following authors:

CRUICKSHANKS, in the 2d edition of Dr ROLLO's book on Diabetes.

FOURCROY and VAUQUELIN's Experiments on the Urine of the Jaundiced, Philos. Magaz. vol. xxiii. p. 331. They found a substance in the urine analogous, to the yellow acid which is formed by the action of the nitric acid on muscular fibre.

BERTHOLLET, on the Urine of Gouty Persons, Journal de Phys. tom. xxviii. p. 275.

CABALLE's, Analysis of Diabetic Urine, Ann. de Chim. tom. lv. p. 64..

The urine of persons affected by diabetes, has also been examined by NICOLAS, Annal. de Chim. tom. xliv. p. 32. ; and by THENARD and DUPUTREN, Annal. de Chim. tom. lix. p. 41. Also Dr W. HENRY's Analysis of Diabetic Urine, Medico Chirurg. Trans. of London, vol. ii.

* Philos. Mag. vol. xxxii. p. 167.

CHAPTER II.

ON THE ORGANIC DERANGEMENTS OF THE URINARY ORGANS.

SECT. I.

OF THE ORGANIC DISEASES OF THE KIDNEY.

THE secretion of urine is sometimes wholly or partially interrupted, constituting the disease called *ischuria renalis* *.

The kidneys are sometimes inflamed.

I have seen the smaller branches of the renal artery, distended with blood in persons who have died with the symptoms of diabetes; but this morbid appearance is by no means constant.

Suppuration is not an uncommon consequence of inflammation of the kidney, when calculi have been lodged within the pelvis of that organ; and we also sometimes meet with the scrofulous suppuration of that organ.

Urinary concretions have sometimes worked their way through fistulous orifices, the consequence of suppuration of the kidney.

* Vid. ETMULLER, de Morb. intern. Cur. cap. 12. FERNELL, de Læsa Urinæ Secretione, p. 314.

In some instances, one kidney shrinks, whilst the other is much enlarged.

When calculi have been lodged for some time within the ureters, the kidney in some instances attains an extraordinary bulk, the papillæ are obliterated, and it is converted into a number of cysts, which are filled by fetid urine, pus, and small calculi.

The kidneys have been in some rare cases reduced to a state of cartilage.

Gangrene of the kidneys, sometimes, though rarely, occurs..

Hydatids have frequently been found within the kidney, or attached to its surface, and sometimes the greater share of both kidneys has been converted into a cluster of hydatids.

The kidney very rarely becomes scirrhous: When reduced to that morbid state, it sometimes attains a large size.

Dropsy of the kidney is a disease which is by no means rare, and the water is collected either within the substance of the kidney, or within its capsule.

Lieutaud has remarked, that the kidneys have sometimes been converted into an earthy substance, and sometimes into bone.

The tunica adiposa of the kidneys has sometimes been converted into a steatomatous substance.

Organic derangements of the *renal capsules* are very rare. Abscesses have occasionally been found within them; and Lieutaud has described

small granules of stone as being found within them, and sometimes they have been converted into cartilage.

SECT. II.

ORGANIC DERANGEMENTS OF THE URETERS.

THE ureters have sometimes been much extended, in consequence of calculi lodged within them, and impeding the flow of urine into the bladder; or when the neck of the bladder is obstructed, I have seen them nearly as large as the intestinum ileum.

Pus and hydatids have been occasionally found within the ureters.

The ureters have been occasionally ruptured.

The ureters are frequently spasmodically contracted.

In a few cases, the coats of the ureters have attained an unnatural thickness.

SECT. III.

OF THE ORGANIC DERANGEMENTS OF THE BLADDER.

THE muscular fibres of the bladder of urine sometimes become paralytic or spasmodically af-

fected; and these affections, which are often limited to the neck of the bladder, are either idiopathic or symptomatic.

The bladder is also subject to inflammation, and the inflammation is sometimes limited solely to the neck of the bladder, and sometimes to the internal coat of that organ.

The innermost coat of the bladder, being a mucous membrane, is subject to all the organic derangements of membranes of that description.

Polypi, similar to those of other mucous membranes *, sometimes grow from the internal coat of the bladder.

Fungous excrescences sometimes are found connected to the internal coat of the bladder, which are often encrusted by calculous matter.

Scirrhous tumours are sometimes found within the bladder; these tumours are of different sizes.

The bladder has sometimes almost entirely filled, by a substance not unlike the brain in its consistence.

The veins of the internal coat of the bladder, sometimes become varicose.

The bladder sometimes forms part of the contents of a hernial sac.

I have described a case †, in which the bladder has been displaced, in consequence of a procidentia of the rectum, and prolapsus uteri.

* Vid. the Description of Polypi, connected with the mucous membrane of the stomach and intestines.

† Vid. Morbid Anatomy of the Gullet, Stomach, &c. p. 523.

The bladder has sometimes been enormously distended. I have seen a case, in which the bladder contained 10 lbs. of urine.

The bladder is, on the other hand, occasionally very much contracted. This sometimes happens from the inordinate contraction of the muscles of the bladder, as in persons who have been killed by hanging, but more frequently it is the effect of disease, and owing to the great thickness of the coats of the bladder, especially of the muscular coats, which become not only thicker, but also redder than in the healthy state.

The bladder has on some occasions been contracted in its middle, so as to resemble an hour-glass, in consequence of the irritation of a calculus of the bladder.

The bladder has sometimes been divided into three distinct compartments.

Cysts, which communicate by a narrow neck with the general cavity of the bladder, have sometimes been observed, and such cysts are generally of different sizes, and filled by calculi.

The coats of the bladder have sometimes been ruptured in consequence of ulceration.

Rupture of the bladder also sometimes takes place from inordinate distention.

Gangrene of the bladder has been described. The rectum sometimes communicates with the bladder of urine, and air is discharged with the urine.

Worms have also been discharged along with the urine

Lastly, Hydatids have been discharged along with the urine, or have been found after death within the pelvis of the kidney or bladder of urine.

SECT. IV.

ORGANIC DERANGEMENTS OF THE URETHRA.

INFLAMMATION of the internal membrane of the urethra is very common, which has sometimes been followed by a contraction or stricture of the urethra, especially in the membranous part of it, or two or three inches from the glans, which are naturally the narrowest parts of that canal.

There are different kinds of stricture of the urethra.

1. The sides of the urethra approximate each other for the space of an inch, or only half an inch; and this is attended by the obliteration of the corpora spongiosa urethræ; and the urethra, where it is diseased, loses its contractile power.

2. There is a kind of stricture occasioned by a morbid growth or ridge from the sides of the urethra, which diminishes to a greater or less extent the diameter of that canal, which is in some cases very narrow; hence called *bride* by the French: and sometimes this kind of stricture divides into branches, as in Plate xl.

3. In some rare cases, the greater part of the urethra has been constricted, as when the urine does not flow through it, but through an artificial opening in the bladder.

4. Stricture of the urethra sometimes originates from the imperfect formation of that canal.

The urethra behind the stricture is much enlarged, and sometimes it gives way, and the urine is discharged at a fistulous orifice in the perineum.

Explanation of Plate 40th.

This plate was copied from a specimen of an unusual variety of stricture, which was followed by a fistula in perineo.

The urethra between the stricture and the bladder, was somewhat enlarged, as also that portion between the stricture and the glans, so that the urethra represents two cones, with their apices joined at the stricture.

The coats of the bladder were also somewhat thickened.

A probe has been inserted into the fistula.

Authors on the Organic Derangements of the Urinary Organs.

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Mr J. HUNTER, on Lues Venerea.
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Edinburgh Medical and Surgical Journal, vol. i. p. 416.
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PART XVIII.

CHAPTER I.

ON THE ORGANS OF GENERATION OF THE MALE.

SECT. I.

GENERAL OBSERVATIONS ON GENERATION.

GENERATION is one of the greatest mysteries in the animal economy.

There is much variety as to the means by which generation takes place in the vegetable and animal kingdoms. In both, the young is attached by some means to the parent, and the separation of the one from the other, is the birth.

The structure of the organs of generation is much diversified in animals.

1. The most simple state of generation has been called the *gemmiparous*, by which is understood the generation by shoots, as in trees, and in some of the mollusca.

2. Some worms are multiplied *by being divided*, as polypi, &c.; in these, there is no distinction of sexes, no copulation.

3. In some instances, both sexes are united in the same individual, as in the hermaphrodite, and in monœcious plants; but in others, though each individual possesses the parts of both sexes, yet the assistance of another individual, which it fecundates, or by which it is fecundated, is necessary, as in many worms and snails.

4. In the higher orders of animals, the *sexes are distinct*, and certain organs of the male are appropriated to the formation of a fecundating liquor, and there also are certain organs of the female which may be fecundated.

Fecundation is accomplished by the deposition of the male semen, in or about the germ.

In many instances the semen is applied to the ova only after they have been deposited, as in many fishes, and frogs.

In the class Mammalia, the semen is introduced by the penis into the vagina during copulation; thus the ova are fecundated within the body of the female, and the fœtus is not discharged until it is capable of independent existence.

The effect of copulation is very different in different classes of animals. In general, only one pregnancy is the result; but in some animals, as in domestic fowls, the influence of a single copulation extends to all the eggs the hen lays in eight or ten successive days; and it has been stated, that

the influence of one copulation extends in the plant-louse, (the aphis,) to four or five generations.

The germ, which is separated, is involved in an organized mass, to which it is connected by blood-vessels, by which it is nourished.

Animals are oviparous, ovo-viviparous, or viviparous.

Birds are *oviparous*. The chick is detached, and involved in its membranes, by the vessels of which it is nourished.

The ovum of the viper is retained within the body of the mother, until the contained germ be hatched; the viper is hence *ovo-viviparous*.

In all the class mammalia, the young is attached to the internal surface of the uterus of the mother, and by her juices it is nourished for a certain time, and is not born until it be capable of an independent existence. All this class is therefore *viviparous*.

The organs of generation of the human body are of a complicated structure.

It is proposed to describe, in the *first* place, the structure of the testes by which the semen is prepared, and the tubes connected with it, by which it is carried to certain receptacles, called *vesiculæ seminales*; and, in the *next* place, The structure of the prostate gland, which prepares a fluid which is mixed with the semen; and in the *third* place, The structure of the organs of copulation, by

which the semen is introduced within the vagina of the female.

The female organs consist of the ovaria or testes muliebres, from which the rudiment is derived, and of canals through which this passes to the uterus of the mother, within which the young is retained and nourished for a certain time, and afterwards expelled; and of a vagina or canal designed for the reception of the male penis, and for giving passage to the contents of the uterus.

SECT. II.

OF THE SITUATION, AND RELATIVE CONNECTION, OF THE MALE ORGANS OF GENERATION.

BEFORE proceeding to describe in detail the organs of generation, it may not be improper to make mention of their relative situation and connection, which only can be well seen by removing one of the ossa ilia, so as to give a lateral view of the pelvis. The cavity of the pelvis is occupied chiefly by the bladder of urine and the rectum.

The peritoneum may be traced from the abdominal muscles, which it lines upon the upper and back part of the bladder of urine, from which it is reflected upon the rectum, and then to the os sacrum.

The neck of the bladder is seen surrounded by a thick substance, the prostate gland, which ad-

heres intimately to the symphysis pubis. The urethra having emerged from the prostate gland, passes downwards and forwards, and the vesiculæ seminales lie between the rectum and bladder, enveloped in a quantity of cellular substance.

SECT. III.

OF THE ORGANS BY WHICH THE SEMEN IS PREPARED.

Of the Testes.

THE testes, before puberty, are of a small size. There is frequently a slight difference in the size of the testes of the opposite sides.

The testes are placed obliquely, with one end upwards and forwards, and the other downwards and backwards; and are fixed to the body by means of the spermatic cord, which is attached to the superior part of the gland.

The testes are somewhat of an oval form, flattened at the sides.

There is a thin and elongated body, called from its situation *epididymis*, which passes along the outer and back part of the testis. The epididymis is somewhat larger at its upper and lower part, where it is fixed to the body of the testes; hence anatomists describe the *globus major*, or head of the epididymis, and *globus minor*, or lower part of it.

There is a small tube which arises from the lower part of the epididymis after it has been reflected, through which the semen passes, which has been called the *vas deferens*.

The testes are contained in a sort of bag, called *scrotum*, covered by scattered hairs; the skin of which is browner; more largely supplied with sebaceous glands; and possesses a larger share of contractile power than in any other part of the

The scrotum is lined by cellular substance, which has somewhat of a pale red colour, from the number of blood-vessels distributed upon it, and which has been by some anatomists described as a muscle, under the name *dartos*; but even in the most robust subjects, the muscular fibres are not visible.

There is very little fat contained within the scrotum, excepting near to the under abdominal aperture; because the pressure or unnatural accumulation of fat might have injured the structure or function of the testes.

The scrotum is divided into two sacs by a partition, which is composed of cellular substance; opposite to which there is a ridge in the spine of the scrotum.

The spermatic cord is also covered by a sheath of peritoneum and fine cellular membrane, which in herniæ sometimes attains a considerable thickness *,

* This covering of the cord has been fully described by Dr Peter Camper in the *Explanation of his Plates on Hernia*,

and by a muscle called *cremaster*, which arises from the internal oblique and transverse muscles of the abdomen, and distributes its fibres upon the external coat of the testicle, called *tunica vaginalis*.

By means of this muscle, the testicles are drawn upwards during coition, and also somewhat compressed.

There are two coats proper to the testicle; the external, called *tunica vaginalis*, is a prolongation of the peritoneum, which forms a shut sac, and covers the testicle, as the pericardium covers the heart, but not in quadrupeds †, and is reflected over the testis, covering the epididymis, and part of the spermatic vessels, to which it closely adheres †.

Within the vaginal coat, there is a much whiter coat; hence named *tunica albuginea*, which very closely adheres to the body of the testicle, and which is perforated at its posterior part by the seminal tubes and blood-vessels of the testes. This coat is thick, and, in the healthy state, possesses but a small share of elasticity.

Upon cutting through the tunica albuginea, the brown-coloured glandular part of the testes which is of a pulpy consistence, presents itself. It may be drawn out into threads.

which were published by Dr Sœmmering; hence this sheath has sometimes been called Camper's *fascia*.

† Vid. Monro, Medical Essays, vol. v. art. 20.

The glandular part of the testicle is partially divided into lobes or parts, by a number of processes from the tunica albuginea testis, called the septula testis.

Of the Seminiferous Tubes of the Testicle.

Upon steeping the testicle for some time in water, it may be resolved into a great number of small convoluted threads or tubes, which, according to my Father, do not exceed the $\frac{1}{200}$ part of an inch in diameter; and when filled with mercury, the $\frac{1}{120}$ part of an inch. These seminiferous tubes may be filled by mercury, their coats being of considerable strength; and upon these, the smaller ramifications of the spermatic arteries are distributed.

The convoluted seminiferous tubes are cylinders, and do not join into trunks like the ducts of other glands, but pass into the rete testis at the back of the testis, where the epididymis is joined to it. My Father has calculated, that the testis consists of 62.500 tubes, supposing each to be one inch long; and that if the tubes were united, they would be 5208 feet and 4 inches long *.

* "Ut vero pleniorem et clariorem ductuum testis seminiferorum conspectum exhibeamus, eorum diametrum, numerum, uniuscujusque dein longitudinem, et hinc flexuum numerum quem ab origine ad rete testis usque perficiunt, ad calculum revocare liceat. Non difficillimum inveni ductuum qui mercurio turgebant dia-

The semen passes from the body of the testicle to the epididymis by twelve or fourteen tubes, which have been called *vasa efferentia.*

metrum accuratissime dimetiri, quum in multis locis ductus tres vel quatuor contigui sint, et post accuratissimas mensurationes, plus quam simplici vice repetitas, eos ad $\frac{1}{120}$ pollicis æstimo. Cum vero mercurius ad ductuum originem non refluxisset, ni, quantum mercurii pondus eos distraxerat, notum esset, calculum ex eorum diametro cum testis mole collata instituere ineptum esset. Ductus igitur octo vel decem ex testiculo recenti, mercurio non repleto, explicui, ad latera inter se composui, et, capta mensura, uniuscujusque diameter ad $\frac{1}{200}$ pollicis circiter tantum ascendit; unde mercurii infusionem ductuum diametrum ad rationem 10 : 6 i. e. 5 : 3 adauxisse apparuit. Testiculum dein, tunica albuginea abscissa, in aquam immersum, cylindro $\frac{5}{4}$ pollicis lato et pollicem alto æqualem notavi; et quoniam inter se cylindrorum lumina sunt, ut diametrorum quadrata, testis ex 62,500 ductibus constabit, quorum singuli pollicis longitudine sunt; unde, si omnes sibi invicem in unum ductum anneceterentur, 62,500 pollices, *i. e.* 5208 pedes et pollices 4 longitudine expleret.

"Antea testem in multos ductuum fasciculos dividi, qui conicæ quasi figuræ sunt, et conorum apices reti testis affigi observavimus. Unicum fasciculum, quantum fieri potuit, accurate exsecui, (tubulorum enim fasciculos ad origines suas paullulum implicari supra notavimus,) ponderavi, et testis totius $\frac{1}{130}$ pondere aequalem comperi. Hinc igitur, si unusquisque fasciculus unum tantum ductum contineret, ejus longitudo pedes 34 et pollices 8 excederet; accuratissime vero teste, mercurio injecto, explorato, omnes tales fasciculos binos ductus tenere, qui ad rete testis in unum ductum rectum conjunguntur, animadverti. Unde uniuscujusque longitudo pedes 17 et pollices 4 superabit. Hactenus arteriarum, venarum, nervorum, &c. ramulos, qui intra testem scatent, in rationem non adduximus; sed in cadaveribus, testis tertiam partem ad plurimum vix occupant; qua

The epididymis is in part composed of the vasa efferentia, and of a single convoluted seminiferous tube.

Each vas efferens is convoluted into a conical-shaped body, called a *vascular cone*, the apex of which looks to the body of the testicle. The vascular cones are connected by cellular substance, and united into a single tube *, which though not more than $\frac{1}{80}$ part of an inch in its diameter, is upwards of thirty feet long, and by its convolutions forms the greater part of the epididymis. The ramifications of the spermatic and epigastric arteries and veins are distributed upon the epididymis.

etiam subducta, uniuscujusque ductus longitudo duodecim circiter pedes explebit. Sin autem flexuum numerum supputemus etiam, vereor ne fidem superet; vix enim ultra $\frac{1}{40}$ pollicis eundem cursum rectilineum servant, ita ut, ab origine sua ad testis rete, flexus 5760 singuli perficiant.

Hinc testem animo depingamus, quasi ductuum 300, qui vasis sanguineis ornantur, congeries esset, quorum uniuscujusque diameter $\frac{1}{200}$ pollicis sit, et ejus longitudo pedes circiter 12, flexus 5760 ab origine ad finem perficiens. *Tent. Med. inaug. de Sem. et Test. in var. Animal. an.* 1755.

* Ut, de ejus fabrica, ex facili et certo certius constaret, sequentia experimenta prius exposueram †; nempe si, inter infundendum mercurium, ullæ epidydimidis parti, præter caput ejus, vas crepuerit, vel si unum tantum vas vinculo constrinxerimus, nos frustra, ultra rupturam aut vincturam, mercurium propellere conari. Vel, si epidydimida transversim dissecuerimus, deinde mercurium vi insigni in vas deferens adegerimus, per unicum

† Edinr. Physical Essays, v. 1. art. 16.

The epididymis is in some very rare instances divided into two branches.

tantum epidydimidis sectæ orificium prosilire. Quæ quidem experimenta extra dubitationem clare evincunt, totam epidydimidia, præter caput, unico funiculo miris modis flexo constare, dum in quibusdam animalibus, ut postea patebit, organorum tenuitas aut structuræ perplexitas nullum aliud hujus rei veritatis argumentum perspicuum admittunt. Ex illo autem tempore, epidydimida mercurio turgidam, variis in partibus, in vas unicum subtile sæpius resolvi, ne quidem mercurii guttula effluente.

"Unicum esse canalem comprobato, longitudinem ejus supputemus. Quo loco coni vasculosi in unum conjunguntur, canalis hic tenuissimus apparet, et, dum epidydimidis globum minorem versus progreditur, paullulum sensimque crassior fit; ad globum minorem subito magis ampliatur, et, paucis exinde flexibus factis, vas deferens evadit. Exinde vix non multum a veritate decedes, si canalem huncce, mediam circiter epidydimida, dimetiaris, et pro regula, in calculis subducendis, ponas. Accuratissimis hac ratione mensuris in variis cadaveribus captis, diametrum ejus $\frac{1}{80}$ pollicis æquiparantem inveni. Epidydimide ponderata, dein mercurio infuso repleta, iterumque librata, pondus ejus drach. ii ss. auctum animadverti. Argentum vivum, quo usus sum, aquam 13 pondere superavit. Ex hisce datis †, calculis subductis, apparet, hujusce canalis longitudinem 30 pedes et pollices 11 excedere, et, quum, communi flexuum ra-

† Pollex cubicus $8145\frac{5}{11}$ tubulos continet, quorum uniuscujusque diameter $\frac{1}{80}$ pollicis æquat—aquæ pollex cubicus 253 gr. Troica ponderat, (Vid. Phil. Trans. vol. 45. p. 447.) Hinc aquæ uncia $=\frac{480}{253}$ pollicis cubici; et argenti vivi unc. i. $=\frac{480}{253}$ pollicis cubici per 13 divisum, i. e. $=\frac{480}{3289}$; itaque argenti vivi drach. i. $=\frac{60}{3289}$ et drach. iiss. $=\frac{150}{3289}$. Idcirco denique $3289 : 150 :: 8145\frac{5}{11}$: ad ductuum numerum unius pollicis longitudinis qui in drach. iiss continentur, vel ad pollicum numerum in epidydimide, i. e. ad pollices 371 et ultra, vel ad pedes 30, et pollices circiter 11.

There is sometimes a small seminal tube two or three inches long, and which has a blind end leading out from the epididymis, and this tube sometimes follows a tortuous course.

Explanation of Plate 39th.

This engraving is intended to explain the structure of the testicle and epididymis.

It was taken from a preparation of the testicle, which was made by my Father, while prosecuting his medical studies at Berlin.

The drawing was made by that distinguished draughtsman, HOPFER of Berlin, in 1756.

AA point out the body of the testicle; the greater part of which, is composed of convoluted seminal tubes.

BB, the seminal tubes running upwards to the rete testis, which is marked by the letters CC.

DD, the vasa efferentia.

EEE, the coni vasculosi.

EFGH, the vascular cones united in one tube, to form the epididymis; I,I, which has been unravelled, to shew that it is composed of a single tube.

K, the vas deferens leading out from the epididymis.

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tione habita, vix ultra $\frac{1}{30}$ pollicis rectilineus progrediatur, 11,100 flecti.

"Ex dictis patet, semen, a ductuum serpentinorum intra testem origine ad vas deferens usque, vasa percurrere, quæ singula 16,860 plicantur, et, si in rectitudinem exporrigerentur, 42 pedes longitudine excederent."

SECT. III.

OF THE SPERMATIC CORD.

THE spermatic cord is composed of the spermatic artery, which arises from the fore-part of the aorta, of the accompanying veins, nerves, lymphatic vessels, and the vas deferens, united by cellular membrane.

The spermatic artery, which supplies the testis with blood, arises from the fore-part of the aorta a little below the renal artery. It descends, crosses the ureter, becoming gradually larger; lies over the iliacus internus muscle, and soon reaches the upper abdominal aperture, where it covers the root of the epigastric artery; it then passes obliquely downwards and inwards along the inferior edge of the internal oblique and transverse muscles of the parietes of the abdomen, and passes out at the under abdominal aperture, where it is much larger, in consequence of the addition of the cremaster muscle: it then follows a straight course downwards to the testis.

The spermatic artery is of small calibre; in its course to the testis is much convoluted, and its branches are distributed upon the epididymis, and body of the testicle.

My Father examined with great attention the ultimate branches of the spermatic artery, both

in its uninjected and injected state, with the view of discovering whether or not there were any knots or acini at the terminations of the artery. But he could not discover any appearance of these. The testes, therefore, afford instances of a gland of a simple structure.

The spermatic veins, which abound in valves, are larger than the corresponding arteries; and they terminate in the fore-part of the vena cava.

The lymphatic vessels of the testicle are large and numerous.

Of the Vas Deferens.

Through the cylindrical tube, called *vas deferens*, the semen is conveyed to the vesiculæ seminales.

This tube arises from the posterior and inferior part of the epididymis, and continues its course along the back-part of the spermatic cord.

The calibre of this tube is very small, in proportion to the size of the tube; its coats being of considerable thickness; and when pressed between the fingers, communicate the same sensation as a whip cord. This tube ascends through the under abdominal aperture; and at the upper abdominal aperture, separates from the spermatic cord; passes downwards and backwards along the psoas muscle, and is then fixed to the lateral

part of the bladder; descending obliquely from without inwards; it passes behind the umbilical artery; crosses the ureter at the lower surface of the bladder, and is connected to the intestinum curvum.

In the vicinity of the prostate gland, the vasa deferentia are nearly in contact; and are considerably expanded, and join with the vesicula seminalis at an acute angle. There is a cylindrical canal, about an inch long, common to the vas deferens and vesicula seminalis, which perforates the prostate gland, and opens on the under surface of that part of the urethra, which is surrounded by the prostate gland, or at the side of that fold of the membrane of the urethra called *caput gallinaginis*.

SECT. IV.

OF THE VESICULÆ SEMINALES.

THE *vesiculæ seminales* have a flattened appearance, and are surrounded by a large quantity of cellular substance. They vary in breadth and in length in different instances *. When cut into,

* "Et in iis quas explicui diversitas maxime quidem insignis est: in aliis vix ultra appendices 3 vel 4 vidi, in aliis 20 fere, et ex iis plures iterum ramosas †. Modo autem vesiculæ cera

† Vid. Tab. iii. fig. 2. and 3.

after being distended and dried, they exhibit a cellular structure.

Upon accurately examining the structure of the vesiculæ, after dissecting off the cellular substance, they are found to be composed chiefly of a long tortuous canal, shut at its upper end; from the sides of which, similar, but shorter tubes, varying in their number in different persons, are sent off.

The vesiculæ are placed obliquely, and nearly touch each other at their apices; but are at some distance at their base, which are directed backwards.

The structure of the vesiculæ is nearly similar to that of the vasa deferentia; each has a strong cellular outer coat, but no muscular fibres are seen under the external coat.

repletæ membranas sine plicarum dissolutione auferamus, veram aptissime fabricam detegimus ‡. Multis etiam quadrupedibus structura difficilioris adhuc quam in homine indaginis est; exemplo sit erinaceus." Vid. *Tent. Med. Inaug. de Test. et Sem. in var. animalibus.*

‡ Tab. iii. fig. 4.

SECT. V.

OF THE PROSTATE AND OTHER GLANDS, WHICH SECRETE FLUIDS WHICH ARE MIXED WITH THE SEMEN.

THE *prostate gland* is in structure firm and dense, like a chesnut in figure, and divided by a fissure into two large lateral lobes.

The superior surface of it corresponds with the arch of the pubis, and is in part covered by a fibrous expansion, named the *inferior ligament* of the bladder.

On the inner and back part of the urinary bladder, near to its neck, its internal membrane is elevated by a minute oblong protuberance of the prostate gland, which has been described, and represented by SANTORINI *, and also by MORGAGNI, and by LIEUTAUD, who has called it *la luette vesicale*.

On the posterior outer part of the prostate gland, between the seminal ducts, MORGAGNI has obsersed, his assistant (INCISOR) discovered another protuberance, on the posterior part of the gland. My Father, who has lately examined this matter with attention, assures me, that he has not found this protuberance, and it is rarely observed, even when the prostate gland has attained an unnatural bulk.

The prostate gland is connected also to the upper surface of the intestinum curvum ; and when

* Vid. his Obs. Anat. pub. 1724. tab. ii. fig. 2d, letter I.

that bowel is much distended, it rises slightly on the prostate gland, and is thus liable to be cut in the lateral operation of lithotomy.

There are ten or twelve ducts leading from this gland, which open obliquely into the urethra around the orifices of the seminal ducts, which are common to the vasa deferentia, and vesiculæ seminales.

These ducts, which, with their exceedingly minute cylindrical beginnings, compose the greater share of the prostate gland, were filled with wax by my Father, upwards of forty years ago, and have since been annually demonstrated in his Courses of Lectures, along with an engraving of these ducts, executed by Mr T. Donaldson in 1762.

The prostate is covered by cellular substance; by a plexus of veins; and by a portion of a few scattered muscular fibres, which ALBINUS has described under the name *compressor prostatæ*, but which constitute a portion of the levator ani muscle.

This gland is largely supplied with arteries, veins, nerves, and lymphatic vessels.

Of Cowper's Glands.

Cowper's glands are two small bodies, of a light red colour, one of which is situated on each side of the bulb of the urethra. They are about the size of a pea. Each of them has a separate excretory duct, about half an inch long, which perforates the membranous part of the urethra with a degree of obliquity. Sometimes these glands are not to be found.

The nature of the fluid, secreted by these glands, has not been discovered.

SECT. VI.

OF THE PENIS.

THE *penis*, the vehicle by which the semen is introduced within the vagina of the female, is of a cellular structure, in order that it may be occasionally elongated, distended, and erected.

The cellular structure of this organ is divided between two tubes, called *corpora cavernosa penis*, which are inclosed within a strong fibrous and elastic membrane, which bears a resemblance to a ligament, and which are disunited by an imperfect partition, so that air or water thrown into one corpus cavernosum, readily fills the other.

Both extremities of the corpora cavernosa are smaller than their bodies, and covered at their anterior part by the glans penis; behind, they divaricate from each other, like the strokes of the letter Y, under the symphysis pubis; and becoming gradually smaller, are inserted on each side by their conical extremities, into the ascending branches of the ossa ischia.

The intervening spaces between the corpora cavernosa penis, are occupied by the *vena ipsius penis*, and the *urethra*; the former is placed upon the upper, and the latter upon the under surface of the penis.

The greater part of the urethra is inclosed within a tough membrane, and a plexus of arteries and veins, which plexus is expanded into a large conical-shaped body, called *glans penis*.

The penis is fixed to the symphysis pubis, by means of a ligament, called the *ligamentum suspensorium penis*.

The penis is covered by skin and cellular membrane, but not by fat.

The penis is amply supplied with nerves; the trunk of which runs along the dorsum penis.

The branches of the pudic arteries, are distributed upon the cells of the penis; and the veins, which correspond with these, originate from the cells, so that the blood readily flows from the cells, into the smaller branches of the veins of the penis.

There are also many lymphatic vessels, proper to the penis, the larger of which are disposed along the dorsum penis, and run into the upper cluster of inguinal lymphatic glands.

SECT. VII.

OF THE MUSCLES WHICH ASSIST IN EXPELLING THE SEMEN.

ISCHIO-CAVERNOSUS, or *Erector Penis*.

THIS muscle covers the crus penis, and takes its rise from the tuberosity of the ischium; the fibres

adhere to the inner side of the ascending branch of that bone, and the muscle terminates in a flat tendon, which is inserted into the ligamentous membrane of the corpora cavernosa, where the corpora cavernosa are united to each other.

This muscle is supposed, by compressing the crura penis, to be essential to the erection of the penis; it may also tend to draw the crus penis downwards towards the tuber ischii.

BULBO-URETHRALIS, OR *Accelerator Urinæ.*

This muscle takes its rise by a thin tendon from the crus and origin of the corpus cavernosum penis; it is also connected with the membranous part of the urethra, and sphincter ani.

The fibres of this muscle descend obliquely, and are inserted into the muscle of the opposite side, at the middle of the bulb of the urethra.

By this muscle, the urethra is compressed, and its contents are expelled; and it contributes also to the erection of the glans penis, by its pressure on the bulb of the urethra, by which the blood is forced into the glans.

Of the Human Semen.

The human semen, when recent, is a white, viscid, heavy fluid, which emits a very peculiar odour. The contents of the vesiculæ seminales, are of a light straw colour, is intermixed with a

number of shining filaments; and hence the semen probably acquires its white colour from its admixture with the liquor of the prostate gland.

When semen is rubbed in a mortar, it becomes frothy. It renders paper stained with violet green, and hence it probably contains an alkali.

As semen cools, it becomes thicker; but about twenty minutes after its emission, it becomes quite liquid.

Ammonia is formed during the exposure of semen to the air.

When exposed to the air, it deliquesces, becomes pellucid, and perfectly liquid.

A hundred parts of the semen, according to VAUQUELIN *, contain 90 of water, 6 of mucilage, 3 of phosphate of lime, and 1 of soda.

The semen also contains a great number of animalculi, which have been said to have a rounded head, with a gently tapering tail †.

* Annal. de Chim. tom ix. p. 64.

† Vid. LEUENHOECK's Description of these Animals; London Phil. Trans. n. 143.

CHAPTER II.

OF THE FEMALE ORGANS OF GENERATION.

SECT. I.

BEFORE proceeding to the more immediate subject of this Chapter, it seems necessary to premise a very brief description of the situation, and relative situation of the contents of the female pelvis.

The upper and back part of the bladder is covered, as in the male, by the peritoneum, which is reflected upon the back-part of the vagina, the cervix and fundus uteri: the peritoneum then descends, and covers the posterior part of the uterus; hence the uterus is included within a doubling of the peritoneum, which forms what has been called *the broad ligament of the womb.*

From the womb, the peritoneum passes to the rectum and then to the os sacrum.

From the preceding description of the course of the peritoneum, it follows, that the anterior part

of the body and neck of the womb, are not invested by the peritoneum, but are in immediate contact with the bladder of urine.

The tubes connected with the fundus uteri, called *Fallopian* or *uterine*, the bloodvessels and nerves of the womb, are also included within the duplication of the peritoneum.

The broad ligament above described, is fixed into the sides of the pelvis, which is thereby divided into an anterior and posterior chamber.

The broad ligament is subdivided into an anterior and posterior part; in the former of which the fallopian tubes are lodged; in the latter, the ovaria, and their ligaments.

There are also *round ligaments*, proper to the uterus; these arise from the fundus uteri, extend obliquely downwards, and pass into the inguinal canals, and terminate in the groins.

They are cords of a pale red colour, composed of longitudinal fibres, of cellular substance, bloodvessels, and nerves.

These ligaments separate into several threads, which are fixed to the mons veneris, and labia externa.

In some women, there is a canal formed by the peritoneum, which lies over the broad ligaments, and into which the bowels sometimes descend *.

* Vid. my Morbid Anatomy of the Gullet, Stomach, and Intestines, p. 517.

Sect. II.

OF THE OVARIA.

The ovaria constitute the most essential part of the female organs of generation; for from these, the rudiment of the fœtus is derived.

The ovaria somewhat resemble the testes in shape and size, in the prime of life, but are more flattened laterally, and their long diameter is placed transversely.

In old age, the ovaria become much smaller.

The ovaria in young women, are sometimes irregular on their surface. The ovaria consist of a spongy yellowish substance; within which, the transparent ovula are contained, which are inclosed within a dense cellular covering, and peritoneum.

That a something necessary to impregnation is derived from the ovarium, is obvious;

1st, As those women are barren whose uterine tubes are obstructed.

2d, From the remarkable difference between the ovaria of a virgin, and those of a woman, who has had children. Upon examining the ovarium after impregnation, a cavity is found within it, which is particularly observable in the cow, is inclosed by a substance which, from its colour, has been called *corpus luteum*.

3d, As the number of these corpora lutea always corresponds with the number of fœtuses.

If a woman has had twins, there are two corpora lutea in one of the ovaria, or a corpus luteum in each ovarium.

In quadrupeds, the number of corpora lutea, always corresponds with the number of young.

4th, As the uterine tubes, from their peculiar form, situation, and structure, are well calculated for giving passage to the contents of the ovarium.

SECT. III.

OF THE UTERUS OR WOMB.

THE womb is a hollow bowel, destined to receive the rudiment of the ovum from the ovaria, and to retain and nourish the fœtus, until it be capable of an independent existence.

The womb varies in size in virgins, and still more so in women who have had children; and after impregnation, it never regains its original smallness.

The womb, which in figure somewhat resembles a flattened pear, has been divided by anatomists into a fundus or uppermost part, a body, a neck, and mouth, or os tincæ, which is placed transversely.

The uterus is loosely connected to the sides of the pelvis by ligaments, and by cellular substance.

There is a doubling of the peritoneum, called the *broad ligament of the uterus*, extending from its sides to the sides of the pelvis, nearly in the course of the transverse diameter of the pelvis.

The cavity of the womb bears but a small proportion to the external bulk of the organ, its parietes being very thick.

The uterine or fallopian tubes are affixed to the fundus uteri.

The uterus is lined by a very soft and very vascular membrane. This at the neck of the uterus is tucked up into rugæ, which are disposed transversely, and by some have been described as being disposed in a foliated direction, like the leaves of the palm-tree.

Between the rugæ, there are several lacunæ, which secrete a mucous fluid.

The parietes of the uterus, when divided, exhibit a fibrous structure; and the fibres are disposed so irregularly, that it is impossible to detect their course.

The uterus is very largely supplied with blood by the spermatic and uterine hypogastric arteries, the branches of which freely anastomose with each other.

The spermatic arteries arise, as in the male, from the fore-part of the aorta, between the renal and

inferior mesenteric arteries, or from the renal artery; they describe a tortuous course behind the peritoneum, and are distributed upon the ovaria and fundus uteri, and anastomose repeatedly with the uterine hypogastric arteries, which are distributed chiefly upon the fundus uteri.

From the arteries of the womb, the menstrual blood is discharged.

In this country, menstruation occurs between the thirteenth and sixteenth years; but if the young woman be confined to hot rooms, sooner. Much depends on peculiarity of constitution, education, kind of life, and climate.

In tropical countries, women menstruate when nine or ten years old; in Switzerland, according to HALLER, when twelve or thirteen years of age; in Lapland, according to LINNÆUS, much later; and instances, he has observed, have occurred, where menstruation took place only in summer.

The menses generally are interrupted about the fortieth year, and cease entirely before the fiftieth year, after which time women generally do not bear children.

There are a few instances in which the menses have continued for a longer period, especially in cold climates, when women have begun to menstruate at a late period.

The time during which the menses continue to flow at each menstruation is various; in general they cease flowing in two or three days;

but in debilitated women they continue to flow for six or seven days. The quantity of fluid discharged is also various; it is greater in warm than in cold climates; in the former, not more than ℥ iv. or ℥ v.; but in the latter, double that quantity.

It has been much disputed, whether the menses are derived from the vagina or uterus. I have seen the menses, in cases of prolapsus uteri, flowing from the vessels of the uterus; we then also observe the mucous membrane of the uterus softer than usual, covered with villi; and can also sometimes see open pores from which blood is discharged.

Mr Brande has lately analysed the "menstruous discharge, collected from a woman with prolapsus uteri, and consequently perfectly free from admixture of other secretions. It had the properties of a very concentrated solution of the colouring matter of the blood in a diluted serum."—"Although," he adds, "I could detect no traces of iron, by the usual modes of analysis, minute portions of that metal may, and probably do exist in it, as well as in the other animal fluids which I have examined; but the abundance of colouring matter in this secretion should have afforded a proportional quantity of iron, did any connection exist between them *."

* Lond. Phil. Trans. for 1812.

SECT. IV.

OF THE UTERINE OR FALLOPIAN TUBES.

THE uterine tubes are connected with the lateral parts of the fundus uteri; are about three inches long, curved in form, like a trumpet, with the narrow end next the uterus; and at the opposite end there are a number of fimbriated processes.

These tubes are covered by the peritoneum, within which in some subjects I have observed distinct muscular fibres, and they are lined by an internal and soft pulpy membrane.

These tubes have been observed, in animals killed soon after coition, firmly embracing the ovaria by their fimbriated extremities.

SECT. V.

OF THE VAGINA.

THE vagina, the channel of communication between the uterus and external organs, is very distensible, curved, continued downwards and forwards, nearly in the course of the axis of the pelvis, and in virgins considerably wider above than below, and rather longer behind than before.

The vagina internally is rugous, and its rugæ are subdivided into anterior and posterior columns, which are very apparent in virgins; and between the rugæ there are numerous mucous ducts for lubricating the parts.

Of the Orifice of the Vagina.

The orifice of the vagina is about half an inch below the symphysis pubis, and surrounded and contracted by its corpus spongiosum, and its sphincter muscle. Its aperture in virgins is very small, being contracted by the hymen, a semilunar-shaped membrane, the concave part of which looks upwards, and in the upper part of which there is an aperture, through which the menses are discharged. There is much variety as to the thickness of the hymen in different women; sometimes it assumes a circular form; is not perforated; and the menses are retained within the vagina.

The sphincter vaginæ, which surrounds and contracts the lower part of the vagina, and presses upon the plexus retiformis of the vagina, is connected with the sphincter ani; and is fixed into the crura clitoridis, where they are united to each other.

The transversalis perinei of the female is similar as to its origin with the corresponding muscles of the male: it is fixed into the sphincter vaginæ, and sphincter ani.

The orifice of the urethra is placed immediately above the orifice of the vagina, to which it adheres intimately, and is surrounded by two spongy eminences, called by authors *corpora glandulosa,* and behind the urethra lies in contact with the rectum; to the upper part of which it is intimately connected.

SECT. VI.

OF THE EXTERNAL PARTS.

FROM the mons veneris, placed upon the symphysis pubis, there are rounded bodies, covered by hair, which descend from the symphysis pubis, and which are united about an inch from the anus by a tranvserse bridle, called *fourchette;* these have been named the *labia externa.*

The labia externa, when cut into, are found to be composed of thin cellular membrane and fat; and their inner surfaces are lubricated by a quantity of sebaceous substance. Upon separating the labia externa from each other, a little rounded body, of a red colour, about one-eighth of an inch long, comes into view, which is in shape the miniature of the male penis, and which, like it, is covered by a fore-skin, or prepuce, under which there are glandulæ odoriferæ; this is the *clitoris.* The clitoris not only resembles the penis in appearance, but also in structure; it is made up of two

cellular corpora cavernosa, which are contained in a ligamentous membrane, and take their origin from the rami of the os ischium, and are capable of distention, and are provided with muscles for that purpose. The clitoris is attached to the symphysis pubis by its proper suspensory ligament; and like the penis, possesses great sensibility.

The corpora cavernosa of the clitoris are considerably longer than the body of it.

From the frenum clitoridis, descend the *labia interna* or *nymphæ*, on each side to the orifice of the vagina. These are various in size in different women, and in different nations*.

The nymphæ are very vascular organs, inclosed in a duplication of skin; consisting chiefly of serpentine branches of the pudic artery, and corresponding veins.

On separating the nymphæ, an orifice presents itself about an inch below these, viz. *the orifice of the urethra;* and immediately under it, the orifice of the *vagina* is placed, which in a virgin is surrounded by the membrane called *hymen*.

Below the orifice of the vagina, and between it and the transverse fold of skin, by which the lower parts of the labia externa are united, there is a small cavity, somewhat in figure like a boat, which hence has been called the *fossa navicularis*.

* The nymphæ are very large in the Hottentots.

The external organs of generation of the female are supplied with blood by the branches of the pudic artery.

The nerves of these organs are derived from the pudic nerves.

The lymphatic vessels of the external female organs of generation pass into the lymphatic glands of the groin; and those at the sides of the pelvis pass into the iliac, and then into the lumbar lymphatic glands.

Conclusion.

From what has been already stated, it follows, that the testes and ovaria are the most important parts of the organs of generation.

The semen, secreted by the testes, is probably propelled through its long course by a muscular power. (though the muscular fibres of the ducts be so small as to escape our imperfect sight,) and is carried to the vesiculæ seminales, within which it remains till it is required.

In consequence of the return of the blood from the penis being prevented, the penis is erected; the corpora cavernosa penis, and corpus spongiosum urethræ are distended, by which the penis acquires the necessary firmness; and by it the semen is introduced into the vagina of the female.

From the stimulus of the male semen, a something necessary to conception passes from the ovaria through the fallopian tubes into the uterus.

Many different opinions have been entertained respecting the origin of the embryo: some have supposed that it is derived from the father; others that it is derived from the mother; and a third description of authors have affirmed, that it is derived from both father and mother.

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CHAPTAL, Journal de Physique for 1787.
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HAMILTON's Midwifery.
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ROEDERER.

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PERON, VAILLAINT and SOMMERVILLE, on the Nymphæ of the Hott ntot.

STELLER, on the same peculiarity in the Kamschatkan Women.

BARROW's Travels in Africa, vol. i.*.

On the Structure of the Ovaria, see DE GRAAF.

On the Physiology of the Organs of Generation.

Vid. HIPPOCRATES, ARISTOTLE, Dr W. HARVEY, DAUBENTON, DE GRAAF, BUFFON, HALLER, RUYSCH, Physiog. vol. viii. MORGAGNI, BLUMENBACH, CRUICKSHANKS, HAIGHTON, SPALLANZANI.

* He says the Nymphæ are sometimes five inches long, and of a livid blue colour, like the excrescence of a turkey.

PART XIX.

OF THE ORGANIC DERANGEMENTS OF THE ORGANS OF GENERATION.

CHAPTER I.

OF THE ORGANIC DERANGEMENTS OF THE ORGANS OF GENERATION OF THE MALE.

SECT. I.

OF THE ORGANIC DERANGEMENTS OF THE SCROTUM.

THE scrotum is subject to all the organic derangements of the skin.

Water, pus and blood, are sometimes effused in the lax cellular substance of the scrotum.

The scrotum of chimney-sweepers is sometimes affected by a peculiar kind of cancer, which has been well described by the late Mr POTT.

SECT. II.

ORGANIC DERANGEMENTS OF THE SUBSTANCE AND COATS OF THE TESTES.

THE testes are subject to a great number of organic derangements.

The testicle is sometimes inflamed, and much swollen; as also the epididymis; and this swelling frequently remains during the progress of life.

Abscesses have sometimes been found in the testicle.

The testicle, in some instances, attains an unnatural bulk from scirrhus; and within such a diseased testis, there are sometimes cysts filled by water.

In the progress of the disease, the spermatic cord is also frequently reduced to a similar morbid state. In the centre of such a testis, there are hard lumps like cartilage within it, or it is intersected by cartilaginous striæ.

Watery tumours are sometimes connected to the body of the testi , and even when the body of the gland is in a sound state.

The testicle sometimes contains a quantity of scrofulous pus.

The testicle sometimes feels soft and elastic; attains a large bulk, in consequence of being fill-

ed by a substance like the brain in a state of putrefaction. This disease has been called the *fungus hæmatodes* *.

There is a disease of the testicle, which has not, as far as I know, been described by any author, in which the body of the testicle is converted into a substance of the colour and consistence of yellow wax.

The testis has been described by Dr BAILLIE, as being sometimes cartilaginous, and sometimes even bony; and occasionally it has been converted into a mass of hydatids.

A wasting of the testicle is perhaps the most common organic derangement of this gland; and this disease in some instances attacks both testes.

Water, pus, and calculous matter, have been said to be sometimes found in the vesiculæ seminales.

SECT. II.

OF THE ORGANIC DERANGEMENTS OF THE COATS OF THE TESTICLE.

THE coats of the testes, being serous membranes, partake of all the organic derangements peculiar to membranes of that description.

* Vid. WARDROP on Fungus Hæmatodes.

On account of the firmness of the coats of the testicle, an inflammation of that organ is attended with great pain, as the membrane does not readily yield.

The coats of the testicle admit of considerable extension, as is evident in cases of swelled testicle and hydrocele, or when blood has been effused within them; and they also regain their former bulk, upon the water which had distended them, being removed; and hence we infer that they possess a considerable share of contractility.

The coats of the testicle sometimes have been partially ossified, and cartilaginous bodies have frequently been observed growing from them.

SECT. III.

OF THE ORGANIC DERANGEMENTS OF THE SPERMATIC CORD.

The spermatic cord partakes of many of the organic derangements of the testes above described: thus it is reduced to a scirrhous, or to a scrofulous state, when the substance of the testicle is in that morbid state.

Sacs, containing water, sometimes adhere to the spermatic cord, or are found within it.

Polypi are sometimes connected to the spermatic cord, and have been mistaken for inguinal herniæ.

The most frequent organic disease of the spermatic cord is the varix of its veins; and when the veins have been much distended, the spermatic cord becomes of an unnatural size, and is to the feeling soft, and has sometimes been mistaken for an inguinal hernia.

SECT. IV.

ORGANIC DERANGEMENTS OF THE PREPUCE, AND BODY OF THE PENIS.

SOMETIMES the prepuce is so tight, that it cannot be drawn back, which is very inconvenient; for, in this case, the sebaceous matter secreted by the glandulæ odoriferæ, cannot be washed off; inflammation follows, and an excoriation, which has been mistaken for a virulent gonorrhœa. The above circumstance led to the practice of *circumcision.*

Sometimes, when the fore-skin has been drawn back, it cannot be drawn forwards.

Sometimes the prepuce has been so much enlarged and hardened, that it conceals the glans penis.

The glans penis is the seat of herpes and venereal chancre.

Venereal verrucæ often appear on the glans or prepuce. They are of a red colour; of an irregular form; and have a spongy fungous appearance; and are often the remains of chancres.

The acrid matter of the glandulæ odoriferæ, scrofula and scurvy, sometimes produce ulceration of the glans penis somewhat like to that occasioned by lues venerea.

Cancer of the penis sometimes occurs in advanced life ; it begins like a warty excrescence ; and from the glans, the disease extends to the body of the penis.

Sometimes the disease begins in the prepuce, and extends to the glans and along the body of the penis ; and at length destroys that organ.

Ossification of the corpora cavernosa penis sometimes takes place.

Gangrene should also be enumerated among the organic derangements of the penis, and is frequently the effect of venereal chancres that have been improperly treated.

Ulcers have sometimes, though very rarely, been observed in the urethra.

Calculi sometimes have stuck partly in the urethra, and partly within the neck of the bladder.

Calculi have also been lodged within the urethra, and sometimes under the prepuce.

In some instances, the urethra has terminated behind the glans penis.

Sect. V.

ORGANIC DERANGEMENTS OF THE PROSTATE GLAND.

This gland is a frequent seat of disease in the old.

The prostate gland often attains an unnatural bulk, from scirrhus, from abscesses within it, from scrofula, and from calculi; and the swelling of the gland is sometimes general, and sometimes partial.

Mr Howard, has observed *, " There are principally two kinds of scirrhi, affecting the prostate gland. The one arises early, and, generally speaking, is a consequence of *gonorrhoea;* and the other at a period much more remote; and towards the decline of life. The one is more immediately the effect of inflammation, of a date not very distant; the other is the consequence of that gradual waste or decay, which naturally takes place in, and ultimately destroys all animal bodies."

A part of the diseased prostate, projects into the urethra, altering the direction of that canal; at other times there is a projection from each side of the prostate, into the bladder of urine, which

* Vid. his Observations on the Natural History and Cure of the Venereal Disease, 2d edit. vol. i. p. 253.

may form a bed for a urinary concretion; and sometimes only the base or the third lobe of this gland is enlarged, so as to form a valve which covers the neck of the bladder. In such instances, the urine may be discharged when the bladder has been moderately distended; but upon the bladder being fully distended, the valve is pushed down, and not a drop of urine is voided.

The veins in the vicinity of the prostate gland, sometimes become varicose.

There have been cases in which the ducts of the prostate gland have been much enlarged.

Authors on the Organic Derangements of the Male Organs.

Dr Baillie's Morbid Anatomy, and Plates.

Adriani, de Tumoribus Testium.

Morgagni, Epist.

Earthy Concretions in the Epididymis,—See Walter, Obs. Anat. 53.

Lieutaud.

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Hartmann and Mathaeus, de Calculis in Vesicula Seminali.

Richerand, Nosog. Chir. tom iv. 2d edit.

J. C. Pohl and Neigefeind, de Prostatis Calculo affectis.

Mr J. Hunter, and Mr E. Home, on the Organic Derangements of the Prostate Gland.

Pott, on the Diseases of the Scrotum and Testes.

Albinus, on the Dilatation of the Corpora Cavernosa Penis.

CHAPTER II.

OF THE ORGANIC DERANGEMENTS OF THE FEMALE ORGANS OF GENERATION.

SECT. I.

OF THE ORGANIC DERANGEMENTS OF THE LABIA EXTERNA, AND OTHER PARTS COMMONLY ENUMERATED AMONG THE EXTERNAL ORGANS OF GENERATION OF THE FEMALE.

THE *labia externa* are occasionally of an unnatural bulk, and œdematous, and very frequently inflamed; in consequence of which, they sometimes have adhered to each other, leaving no passage into the vagina, excepting at the anterior part for the discharge of urine.

The erysipelas, in some instances, attacks the external organs of the female, and spreads rapidly.

Inflammation of the labia, sometimes gives rise to ulceration.

The labia externa are subject to ulcers of different descriptions. Of these, what has been named the *irritable sore*, is perhaps the most distressing.

Venereal excrescences, and polypi, sometimes grow from the labia.

The labia externa, are sometimes the seat of scrofulous and scirrhous tumours.

The bowels have been sometimes protruded into the labia pudendi, in cases of hernia *.

SECT. II.

HYMEN THICKENED.

THE hymen is sometimes so thick, that it cannot be ruptured, and at the same time imperforated; and hence the menses are retained behind it, which sometimes occasion a considerable tumour.

The nymphæ are occasionally much elongated, protruded beyond the labia, and covered by an insensible skin.

The *carunculæ myrtiformes*, sometimes attain an unnatural length, and create much pain.

* Vid. the Morbid Anatomy of the Gullet, Stomach, &c.

SECT. III.

ORGANIC DERANGEMENTS OF THE VAGINA.

Contraction of the Vagina.

THE vagina has been found contracted.

A contraction of the vagina is the effect of original mal-conformation, or of an adhesion, the consequence of difficult labour.

In some instances, the vagina is not of its usual length.

The vagina, though very rarely, has been divided by a partition extending from one end of it to the other, but more frequently a membrane has been observed, to pass transversely across it, and this membrane is commonly placed behind the hymen.

The vagina has, in a few cases, been inverted, from a procidentia uteri.

Mortification of the vagina, sometimes occurs, in consequence of stimulant injections. The mortification is either limited to the internal membrane, or occupies the whole of the vagina.

The bowels have sometimes been prolapsed be-

tween the vagina and rectum, forming the perineal hernia *.

Organic Diseases of the Clitoris.

The clitoris has been sometimes so much enlarged, as to be mistaken for a male penis.

The enlargement is sometimes accompanied by induration, thickening, and the cancerous ulceration.

Scirrhous tumours sometimes have grown from the clitoris.

SECT. IV.

MAL-CONFORMATION AND ORGANIC DISEASES OF THE UTERUS.

THE uterus has been found larger or smaller than usual, and the latter is attended with a similar conformation of the external parts.

The uterus has been found double.

Inflammation of the uterus sometimes takes place after delivery, which inflammation is commonly attended by inflammation of the viscera of the abdomen, and even by that of the fallopian tubes.

* For a more full account of that kind of hernia, see the Morbid Anatomy of the Gullet, Stomach, &c.

This inflammation is accompanied by the effusion of coagulable lymph, and also by suppuration in some cases.

Sometimes the uterus is the seat of a phagedenic kind of ulceration, by which it is destroyed.

Scirrhus of the Uterus.

This disease is most frequent in the neck of the uterus, and in that part which is lodged in the vagina, and it extends to the rest of the uterus. The uterus is much enlarged before ulceration akes place; the neck of it is elongated, and the uterus is open.

Sometimes the scirrhous uterus attains a very large size, and extends to the rectum and bladder; and generally in such cases the vagina is much hardened and thickened, and the lymphatic glands in the vicinity are much diseased.

In such cases, the parietes of the uterus are much thickened, and intersected by cartilaginous lines, and there are frequently cysts in them, which are filled by an ichorous or bloody water; and from the inner surface of these cysts, fungous excrescences grow. Sometimes the whole internal surface of the uterus is in a fungous state.

The section of the parietes of the uterus exhibits the usual characters of scirrhus.

Tubercles sometimes grow from the uterus, and more frequently polypi, which sometimes attain a large bulk, and by their weight produce prolapsus uteri.

The polypi which grow from the uterus, are similar to those which have been already described, as attached to the alimentary canal.

The uterus is also the seat of the fungus hæmatodes, a tumour which bears a strong resemblance in its colour to the brain, and containing cysts filled by bloody serum.

Moles sometimes are found within the uterus, and the latter have been discharged, and the patient has become pregnant.

Earthy concretions have been described in the uterus.

The uterus has sometimes been ruptured at the time of delivery.

Hydatids have sometimes been contained in the uterus; by which it is much enlarged.

These hydatids have sometimes been artificially removed, as in the case alluded to in the second volume, and the patient has obtained a complete recovery.

Water is sometimes collected within the uterus; and if such a patient menstruates, the menses are pale and watery.

In some instances, the water is for a time retained, but in others it comes away in gushes.

Tubercles of different sizes, consisting of a solid white substance, sometimes grow from the uterus, and these are either imbedded within the uterus, or grow from its outer surface.

The uterus is occasionally displaced, or in a state of *prolapsus*; and the displacement sometimes takes place to such a degree, that the uterus protrudes beyond the external parts, which is named the *procidentia uteri.*

The uterus has been in a few instances so much displaced as to fill an inguinal hernia *.

Lieutaud † has described the uterus as being in a few cases changed into an earthy substance; and masses of bone have been found within the cavity of the uterus.

Sect. V.

ORGANIC DERANGEMENTS OF THE OVARIUM.

Dropsy is the most frequent organic derangement of the ovarium.

The ovarium, when dropsical, consists of one bag, or of a number of small cysts, which do not communicate with each other; and the fluid which fills these, is in some cases clear and limpid, but in others yellow and ropy.

* Such a kind of hernia has been described by Senertus, Ruysch and Lallement.

† Tom. 1. p. 323.

The dropsical ovarium sometimes attains a very large size, and sometimes ascends so high as to adhere to the diaphragm.

The ovarium, in old women, is sometimes reduced to a scirrhous state.

The ovarium sometimes attains a large bulk, in consequence of being filled by a suetty substance. Teeth, and even hairs, are sometimes found within the ovarium.

Lastly, the ovaria are sometimes very much enlarged, in consequence of being filled by an ill-conditioned curdly pus, and from the unnatural thickening of their parietes.

The ovaria have been said to be wanting, in which case, the external parts of generation do not attain their healthy size.

SECT. VI.

ORGANIC DERANGEMENTS OF THE FALLOPIAN TUBES.

THESE tubes sometimes have been obstructed, probably in consequence of previous inflammation; and when the obstruction has taken place at both ends of these tubes, they have been found filled by a watery fluid.

The Fallopian tubes, according to Dr BAILLIE, sometimes end in a cul de sac; and according to

the same author, hard tumors sometimes grow from the outer side of these tubes.

It may not be improper to add, that a fœtus has sometimes been lodged within one of the fallopian tubes, enveloped in its membranes, the chorion and amnion.

Authors on the Organic Derangements of the Female Parts of Generation.

Vid. the Works of HAMILTON, SMELLIE, LEVRET, DENMAN, BURNS, BAUDELOCQUE, DIEMERBROCK, PARSONS, HALLER, ARNAUD.

On the Enlargement of the Labia Pudendi.

Cancer of Clitoris, described by SCHMUCKERS, in his Vermischete Chirurg. Schriften, ii.

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Bresl. Samm. 1721.—648.

SAUCEROTTE, Melang. de Chirurg.

PART XX.

CHAPTER I.

OF THE NERVOUS SYSTEM.

Sect. I.

GENERAL OBSERVATIONS ON THE NERVOUS SYSTEM.

Before proceeding to describe the Nervous System, it may not be improper to premise a few general observations on that subject.

In the higher classes of animals, a large mass, called the *brain*, connected with the nervous system, is contained within the skull, and a large cord is contained within the vertebræ of the back, called the Spinal Marrow, and a number of nerves are connected with these. But in the lower animals, there are merely a number of white cords distributed through different parts of the body.

The proportional size of the brain, in respect to the spinal marrow, is very different in different animals.

The brain, in the human subject, bears a larger proportion to the spinal marrow, than in any ani-

mal; and the spinal marrow very much exceeds in bulk any of the nerves connected with it; but the spinal marrow of some warm-blooded animals is much larger in proportion to the brain, and especially in fishes. In these animals the transverse diameter of the brain scarcely exceeds that of the spinal marrow.

The acuteness of the intellectual faculties probably depends on the bulk of the brain; whereas the force and rapidity of voluntary motion appear to depend upon the proportion of the nerves distributed to the organs of sense.

In those animals which are superior to man in strength, the nerves are larger; and in the classes of Fishes and Insects, which are remarkable for the acuteness of their feeling, and the rapidity of their motions, the nerves of the limbs are much larger than in the human body.

The higher orders of animals have the same number of senses as man; but many of the inferior animals are destitute of some of these.

The nerves appear to be tough cords, which is owing chiefly to their investing membranes.

Upon dissecting a nerve, it is found to be covered by membranes similar to those which cover the brain.

The outer membrane is very tough, and fibrous in structure; the second coat is much thinner, and the third is a vascular membrane, similar to the pia mater of the brain.

Besides these coats, there is a membrane which divides each nerve into its component filaments,

which has been called *Neurilema*, which may be distinctly seen after removing the medullary matter, by immersing the nerve in an alkaline solution.

A number of small bloodvessels are distributed upon the neurilema.

The proper nervous substance, when laid bare, appears generally of a cineritious colour; and when examined by the aid of a magnifying glass, seems to consist of a semipellucid substance, in which a more white and opake fibrous-looking matter is disposed in transverse and serpentine lines.

These serpentine transverse lines are most distinct when the nerve is relaxed, but are much less evident upon the nerve being moderately stretched; and when the nerve is much stretched, it appears uniform in its colour and consistence.

Hence, my Father has concluded that by these lines, the nerve is accommodated to the different states of flexion and extension of the limb.

SECT. II.

OF THE PLEXUSES OF THE NERVES.

THE nerves are connected *in three different ways*.

1. Nerves are joined together at acute angles, and form plexuses.

2. Nerves, running in opposite directions, are connected by their small branches, or apices of

these branches, forming networks, which, at first sight, seem to resemble the anastomoses of the bloodvessels.

3. In certain parts of the body, several nerves enter into a knot, called a Ganglion, and from the opposite side of the knot nerves are sent out.

The nerves, in their course, are united by plexuses, in which the fibres of the different nerves are intermixed, and every nerve under the plexus, consists of all the nerves which entered the plexus.

Some of the nerves which run in opposite directions are connected by their small branches; as the second branch of the fifth pair of nerves, with the portio dura of the auditory nerves. In the ox, my Father remarked that the small branches which come off beyond the union of the two larger nerves, consist of the fibres of both.

In the whole nervous system, the particular cords, of which the particular nerves consist, form, according to my Father *, within their proper sheaths a succession of plexuses, in which their fibres are intermixed and combined again. Thus the danger of diseases and injuries of the trunks of the nerves is materially diminished.

* Vid. Nervous System, p. 44.

Of Ganglia of Nerves.

There are communications between a number of nerves; and where these communications take place, there is generally an enlargement or ganglion.

The ganglia are little flattened bodies connected with the nerves, consisting chiefly of medullary matter, which are different in size and shape in different nerves, and even in the same nerve, as in the sympathetic.

All ganglia seem to be similar in their structure.

Many nervous cords may be traced on the surface of the ganglion, from their first attachment to the ganglion, till they have parted from it, without any substance intervening of a different texture from that of the nervous cords elsewhere.

The nerves in their course upon the surface of the ganglion divide into smaller nerves, and are again collected into larger cords, in such a manner, that every nerve that comes out from the ganglion, consists of fibres from two or more of the nerves which enter the ganglion.

The nerves within the ganglia retain their jointed appearance.

The cords which come out from the under end of a ganglion, are generally larger than those

which enter the upper end; but there are exceptions to this rule in the course of the sympathetic nerve.

Every nerve connected with a ganglion appears to contain cords, running in opposite directions; ascending, for instance, and descending; or where nerves are connected to the upper, under or outer part or side of a ganglion, (which is the case of the thoracic ganglia of the sympathetic nerve,) the nerve at the side appears to consist of cords, which divide into ascending and descending cords, that are combined with the cords which compose the upper and under nerves *.

My Father, after having described with great minuteness the structure of the ganglia, has observed: "Upon the whole, all the nerves which issue from ganglia, seem to be formed by a combination of threads from many sources; and, besides this, the nerves, in their passage through a ganglion, seem to receive new energy from the vascular matter of the ganglion.

Hence we understand the reason why *ganglia are most numerous in the nerves of organs of chief importance*; as in those of the heart, or of the intestinal tube. Thus, the intestinal tube receives its nerves from the eighth pair, and perhaps from almost all the spinal nerves. If the first pair of spinal nerves had run to the uppermost part of that canal, and so on, without the intervention of

* Vid. Nervous System, p. 54. and Plate xx. fig. 1. B.

ganglia, by a wound or disease injuring the first pair of nerves, the uppermost part of that canal *should have totally lost the power of acting*: Whereas, if the threads are supposed to be intermixed in the ganglia, we should by such an accident sustain *a loss of the thirtieth part only of the power of the whole tract*; which equable loss would be attended with much less danger than the complete loss of power in the thirtieth part of it.

Or, in the heart, the loss of one-fourth part of the strength of all its four principal sacs would be *less dangerous* than a complete palsy of one of its auricles or ventricles."

SECT. III.

THE arteries divide, like a tree, into smaller branches; but the ramifications of the nerves do not always diminish in size; for many branches are thicker than the trunk from which they have originated.

SECT. IV.

OF THE TERMINATIONS OF THE NERVES.

THERE are certain nerves which are appropriated to certain functions; and by means of others,

we acquire certain sensations; as by means of the nerves distributed upon the organs of sense.

The terminations of the nerves, which are proper to the organs of sense, are only covered by the neurilema; and hence the nerve seems to the naked eye to be of a delicate fabric; but when examined by the aid of a powerful magnifying glass, it appears to be composed of a number of very small threads, which form with each other a most intricate plexus *.

SECT. V.

THE nerves are connected either with the brain or with the spinal marrow; of the former, nine or ten pairs have been enumerated, besides the sympathetic; and of the latter, twenty-nine or thirty pairs, besides the nerves, called *accessory*.

The nerves follow somewhat of the same course as the arteries. They are generally so disposed in the cellular substance and fat, or between the interstices of the viscera and muscles, or between the processes, or on the inner sides of the bones, as to be as far as possible removed from external injury.

* Vid. my Father's Treatises on the Eye and Ear.

SECT. VI.

CHEMICAL ANALYSIS OF THE BRAIN AND NERVES.

VERY few chemical experiments have been made upon the substance of the brain.

THOURET * and FOURCROY † are the only chemists who have made experiments on the brain.

Brain consists of Phosphate of Lime;
——— Soda;
——— Ammonia.

Dr T. THOMSON has observed, "These facts are sufficient to shew us, that, exclusive of the small proportion of saline ingredients, brain is composed of a peculiar matter, differing in many particulars from all animal substances, but having a considerable resemblance in many of its properties to albumen. Brain has been compared to a soap; but it is plain that the resemblance is very faint; as scarcely any oily matter could be extracted from brain by FOURCROY, though he attempted it by all the contrivances which the present state of chemistry suggested, and the alkaline portion of it is a great deal too small to merit any attention ‡".

* Journal de Phys. tom. xxxviii. p. 329.

† Ann. de Chim. tom. xvi. p. 282.

‡ System of Chemistry, vol. v. p. 540.

SECT. VII.

OBSERVATIONS ON THE FUNCTIONS OF THE NERVES.

THE nerves are capable of exercising their functions independently of the brain.

Various arguments may be employed in support of such an opinion.

1. My Father found, after cutting the sciatic nerve of a frog transversely, and after he had cut out all that part of the spinal marrow to which the pelvis and lower extremities are connected, the circulation of the blood continued for many months in the hind-legs; and after wounding or fracturing the bones, the wounds closed, and callus reunited the disjointed parts of the bones, and many new-formed vessels could be seen in the scars, and in the callus. Now, without the action of the bloodvessels, circulation could not have been continued, nor could the callus have been formed.

2. The application of the ordinary chemical or mechanical stimuli to the nerve, which had been previously divided, and beyond the part of it which had been divided, excited convulsions of the muscles for a length of time. In this instance, there can be no influx of nervous fluid from the brain.

3. By experiment, it may be proved, that the nerves, without the aid of the brain, can excite nervous energy for any given length of time. My Father cut out the whole spinal marrow of a frog, which is lower than the third vertebræ of the head; he kept the animal for several weeks, until the wound in the teguments and vertebræ had closed.

The animal did not recover the feeling nor voluntary motion in the hind-legs. He then passed a gold probe through the body of the animal, at the upper part of the pelvis, across the sciatic nerves, and in contact with them.

He then laid the animal on its back, upon a plate of zinc, and found, on touching the zinc with the gold probe, that the muscles of the hind-legs were violently convulsed.

From this experiment it follows, that the nervous energy remained in the nerves for weeks after the communication between them and the brain had been intercepted.

He prosecuted the experiment, by confining the animal in a vessel made of zinc, which he filled half full of water, after he had twisted together the opposite ends of a gold probe; and in this manner, every time the animal altered the position of its body, which it was enabled to do by means of its fore-legs, the gold probe alternately touching, and being separated from the zinc, threw the muscles of the legs into convulsions.

By this apparatus, the legs were daily convulsed several hundred times.

After confining the animal in the above state for several weeks, the convulsions continued to be as frequent and violent the last day of the experiment as they had been the first.

From the above facts, it appears, that nerves may exist after all connection with the brain has been intercepted, and may for a great length of time, not only retain their usual size and structure, but are capable of furnishing nervous energy, sufficient to carry on circulation and secretion, and to excite convulsions of the muscles, when powerful stimuli are applied to the nerves: Therefore, the brain has improperly been named the *origin of the nerves*; the nerves may with equal propriety be named the origin of the brain.

Further, the bulk of the human nerves does not bear the same proportion to the brain as those of many quadrupeds and fishes, which feel acutely, and exercise their muscles with as much force as we do. The size of the nerves bears a proportion to the size of the organs on which they are spent; but the brain is very small.

Further, in some vermes of considerable size, as in the sepia loligo, the brain is exceedingly small; and in the echinus esculentus, it is entirely wanting.

It therefore becomes doubtful, whether we ought, with authors, to consider the brain *as the fountain of the proper energy to the nerves*, or

whether we ought to consider the brain merely *as the medium between mind and body.*

We shall next examine the nerves as being the sources of sensation and motion.

Of Sensation.

Irritation occasions a reaction in animals with or without consciousness, and perhaps without affecting the mind.

Where the mind is influenced, we are said *to feel*, in the common sense of the word.

But in many instances, where the nerve of a muscle is diseased, or has been divided, or after the heart or other muscle has been separated from the body, the puncturing the muscle produces convulsive actions.

Such an effect cannot be explained on mechanical principles: hence there probably has been some kind of feeling, which has produced an action which may be compared to the feeling which vegetables seem to possess, in consequence of which their juices are moved and changed by secretion.

Having endeavoured to show, that, by the medium of the nerves, the mind is rendered sensible of impressions on the body, and enabled to throw the muscles into action; it is incumbent on us, in the next place, to examine into the nature of that

energy by which the nerves perform these two very opposite functions.

The following experiments throw considerable light on this interesting subject.

1. A solution of opium in water applied to the surfaces of the brain and spinal marrow of a frog, renders the muscles of the extremities of its body *paralytic*, almost instantaneously.

2. The water of lauro-cerasus, poured into the stomach of a pigeon, *kills it instantaneously*.

3. The poison of the viper, introduced into the vein of the leg of a frog, *instantly gives pain*.

4. The dividing the spinal marrow, before the poison of the viper is inserted into the vein of its leg, *prevents it from killing the frog*.

5. After cutting out the heart of a frog, and thus putting an end to the circulation of the blood, if a solution of opium be applied to the surface of the encephalon and spinal marrow, or poured into the abdomen, *the muscles of its limbs are deprived of their contractile power*.

It is evident, that, in these several experiments, the poisons act upon the *muscles, by the medium of the nerves*, and not by the medium of the blood, as FONTANA has supposed.

When, therefore, a poison poured into a vein, or the heart of an animal, produces similar effects on the muscles, we may safely conclude, that these are *not owing to the action of the poison upon the blood*, but to its action on the nerves of the blood-

vessels, with which the other branches of the nervous system sympathise.

The next point to be considered, is, *Whether the nervous energy is produced by a fluid, of the same nature with, or nearly resembling that called Electrical?* as has been of late years supposed by many eminent physiologists; especially since the power of the torpedo of giving an electrical shock was discovered by Mr WALSH, and the effects of animal electricity by GALVANI.

That the matter rendered active by the *torpedo* or *gymnotus*, is electrical, appears highly probable or certain, by the experiments of Mr WALSH.

The matter set loose in animal electricity, resembles so exactly the electrical, in its velocity, and in passing through or being stopped by the same substances, and in producing convulsions in the muscles of animals; that it does not appear to me that there are just grounds for doubting of their identity.

But after so much is granted, *it by no means follows, that the nervous energy, or fluid, as it has been called, is electrical*, or that an electrical fluid, by its direct influence, produces the convulsions of the muscles. On the contrary, my Father has endeavoured to demonstrate by experiments, *that the electrical and nervous matter are essentially different from each other;* and that, in GALVANI's experiments, the electrical matter merely proved a stimulus to the nerves.

The nervous energy and electrical matter differ essentially in their properties.

Thus, opium and other poisons applied to the brain or muscles, destroy the nervous energy, but not electrical matter.

On the other hand, mechanical and chemical substances applied to the brain, trunks of the nerves, or muscles, give pain and rouse the muscles into convulsive actions.

Simple pressure of the brain impairs the energy of the nerves, and when that is removed, the effects cease.

Moderate pressure on the trunk of a nerve benumbs the part on which the nerve is dispersed, and takes away the power the mind has, of throwing the muscles into action, on which the nerve terminates.

On removing the pressure, the mind recovers its feeling, and power of acting; from which it appears, that the pressure has produced its effects without destroying the texture of the nerve.

A tight ligature, or a transverse section of a nerve, destroys its powers, even although the divided parts of the nerve are again brought into contact; whereas a ligature thrown around a nerve, or even the dividing it, does not arrest the progress of the electrical matter, providing the cut ends are brought into contact.

After one of the limbs of a living animal is cut off, its muscles may be repeatedly convulsed by irritating its nerves, by means of mechanical or

chemical substances; whereas electrical matter, if collected or accumulated, as in a Leyden jar, discharges itself at once.

1. We find that the electrical matter, whether excited by animal electricity, or collected, as in the common experiments with electrical matter, passes readily along the sciatic nerve of frogs; the parts of which, after being cut transversely, are tied together by a thread.

2. Upon placing a zinc plate under the loins of a frog, which had been separated from the upper part of the body, and with the sciatic nerves exposed, and touching it with a gold probe held in the right hand, as often as the left hand was applied to the toes of the animal, its muscles are convulsed.

3. The parts of the frog being disposed as in the last experiment, and tied together as in the first experiment, upon touching the zinc with the side of a gold probe, held in the hand, and then applying the point of the probe to the sciatic nerve under the ligature, the muscles are instantly convulsed; though the electrical matter had not passed into them, but had moved in the circle formed by the zinc, the gold probe, the loins, and the parts of the sciatic nerve above the point of the gold probe.

4. To prove that the electrical matter had not passed lower than the point of the gold probe, the parts of the frog being disposed as above, on touching the sciatic nerve *above the ligature* with the

probe, convulsions of the muscles were not excited.

But as a ligature on the nerve did not in the first experiment interrupt the electrical fluid; and, as in the fourth experiment, the electrical fluid did not pass lower than the point of the gold probe, there is no reason for supposing, that it should have passed lower than the point of the probe in the third experiment; and, therefore, that, in the third experiment, the convulsions were excited, *not by the electrical matter passing into the muscles, but by the nervous energy roused into action by the stimulus of the electrical fluid.*

5. Upon cutting two living frogs across at the loins, and after laying the posterior parts in opposite directions, and placing these on a zinc plate, on touching with a gold probe held in the right hand, the foot of one of the frogs, if the left hand was applied to the toes of the other, there were no convulsions produced.

This experiment shews, that the fluid produced in animal electricity, *does not excite convulsions of the muscles, whether it passes upwards or downwards through them.*

6. But when after placing the posterior parts of the frog in opposite directions, as in the fifth experiment, and cutting across all the parts of the pelvis of both frogs, excepting only the trunks of the sciatic nerves, and touching a plate of zinc, put under one frog, with a golden probe held in

the right hand, and then applying the left hand to the toes of the other frog, the muscles were immediately convulsed.

In this last experiment, the whole electrical matter produced in animal electricity, passed through the nerves alone, *and excited convulsions of the muscles in which they terminate, whether the electrical matter is passing upwards or downwards along the nerve and muscle.*

From these experiments, it is proved, that whilst the electrical fluid is passing from the toes, upwards along the muscles, it does not throw them into convulsions, but that it does so, as soon as it begins to pass along the trunk alone of the nerve. At that instant, therefore, *the electrical fluid is moving in the direction upwards, and the nervous energy is moving downwards, from the trunk of the nerve into the muscle*, or in the trunk of the nerve, the electrical, and the nervous energy are moving and acting in contrary directions. Hence we are led to infer, that THE NERVOUS ENERGY IS DIFFERENT FROM THE ELECTRICAL, AND THAT THE NERVE IS MERELY STIMULATED BY THE ELECTRICAL FLUID.

The electrical fluid and the nervous, are not the same; and, further, the electrical shock communicated by the Torpedo and Gymnotus, does not proceed from the fluid of their nerves.

In the first place, The brain and nerves of the torpedo resemble exactly the same parts in the skate, and other flat fishes; and hence it is pro-

bable, in the highest degree, that the nervous energy is of the same nature in them, as in other animals, and that similar experiments exciting animal electricity, would prove, that the nervous fluid is very different from the electrical.

In the next place, These animals are provided with very extensive machinery proper to them, and undoubtedly for the purpose of giving an electrical shock, and therefore we ought, instead of supposing that the nerves which terminate upon it, convey to it an electrical fluid, to suppose *that these nerves serve merely to invigorate this machinery, and to enable it to collect electrical fluid*; for if the nervous fluid or energy had been electrical, these nerves should, without the intervention of any machinery, have conveyed their fluid to the surface of their bodies directly, in order to give the shock.

Upon the whole, it appears that a slight electrical shock excites the energy of the nerves, and that a strong one destroys it; *and that there are no just grounds for supposing, that the nervous energy is of an electrical nature.*

Dr Monro *senior*, read the following theory in 1793, to Drs Hutton and Black; but Dr Hutton dissuaded him from publishing it, although it did not seem to him then to be objectionable:

" Whence the active matter is derived, or from what cause it is put in motion, is indeed very dif-

ficult to determine; especially since the metals and water, or moist animal substances, are supposed to be merely conductors of electricity. Is it conceivable, that the different metals and water, or moist animal substances, contain different proportions of latent electrical fluid, or fluid resembling it; and that when the metals and animal substances are brought into contact, such a motion of the electrical or subtile fluid takes place, as produces an equilibrium in the common mass; and that when the metals are again separated from each other, and from the animal substance, each instantly resumes that quantity of the electrical or subtile fluid which is proper to it; and that the rapid circulation of the electrical fluid irritates the nerve, and throws into convulsions the muscles in which it terminates?"

From the preceding observations, it appears doubtful, 1*st*, Whether the brain and nerves are composed of exceedingly minute tubes; or merely of a pulpy matter inclosed within sheaths, formed by a membrane resembling the pia mater, which, besides serving with the external membrane, resembling the dura mater, for the defence of the pulpy matter, and for nourishing it, is capable of communicating to it the nervous energy.

2*d*, It appears that the energy of the nerves is not owing to an electrical matter.

And, 3*d*, That it is probable in the highest degree, that the nervous energy depends on mat-

ter, which is secreted by the vessels, which are dispersed on the pia mater of the encephalon and nerves.

CHAPTER VIII.

OF THE BRAIN AND ORGANS OF THE SENSES.

SECT. I.

OF THE BRAIN AND ITS INVESTING MEMBRANES.

THE name *Brain* has been applied to that mass which fills the skull, which, in the human body, is larger in proportion to the nerves connected with it than in other animals.

The brain has been divided by anatomists into two parts; the larger brain or Cerebrum, the smaller brain or Cerebellum.

The brain is covered on its upper part by the frontal, parietal and occipital bones; its fore-part rests on the orbitar processes of the frontal bone, and its posterior part upon the process of the dura mater, called *tentorium cerebello superextensum*.

The brain is also covered by three coats, called the *dura mater*, the *arachnoid coat*, and *pia mater*. The dura mater adheres very intimately to the internal table of the skull, by a number of bloodvessels and cellular threads, especially at the sutures.

Of the Dura Mater.

The *Dura Mater*, which has been so named, as it has been supposed to be the origin of all other serous insensible membranes, gives a general covering to the brain. The hemispheres of the brain and cerebellum are separated from each other by partitions, derived from the dura mater; and there is also a horizontal or middle septum between the posterior part of the larger brain and little brain, which is derived from the same source.

The dura mater is composed of two layers; and between its component layers, the venous sinuses of the brain are lodged.

Upon the upper surface of the dura mater, there are small bodies, which have been described by PACCHIONI *as being glandular.*

The superior vertical process of the dura mater, called, from its form, the *Falx Cerebri*, separates to a certain extent the hemispheres of the brain. It is fixed to the crista galli of the ethmoid bone; becomes gradually broader as it extends backwards; adheres at its upper part to the frontal, parietal, and occipital bones; and is at length fixed to

the middle horizontal partition between the great and smaller brains.

The *tentorium cerebello superextensum*, or *transverse middle septum*, is fixed to the grooves and transverse ridges of the os occipitis, to the ridges or partes petrosæ of the temporal bones, and to the posterior clinoid processes of the sphenoid bone.

Between the transverse septum and posterior clinoid processes, there is *an oval-shaped aperture*, where the cerebrum and cerebellum are united.

The falx and tentorium cerebello superextensum, the connected and continuous processes of the dura mater, support and stretch each other, and prevent the opposite sides of the brain from gravitating upon each other when we lie on either side; and also support the posterior lobes of the larger brain from pressing on the smaller brain.

The falx *minor* or septum, between the hemispheres of the smaller brain, is fixed to the middle perpendicular ridge of the os occipitis, and terminates at the edge of the foramen magnum ossis occipitis.

There are also venous sinuses on the base of the skull, formed by the dura mater. On each side of the sella sphenoidalis, the dura mater is extended between the anterior and posterior clinoid processes.

The dura mater lines the superior orbitary fissures, and the foramina of the skull; and the dura mater also forms a sheath for the spinal marrow.

The dura mater is supplied with blood from the external carotid artery; as also from the internal carotid and vertebral arteries.

The superior longitudinal sinus, imbedded between the layers of the dura mater, takes its rise at the crista galli of the ethmoid bone, runs along the upper part of the falciform process of the dura mater, becoming gradually larger, and divides, opposite to the most prominent part of the os occipitis, into two lateral branches or sinuses.

The smaller veins of the brain open into the superior longitudinal sinus at its upper and back part, and their orifices are chiefly directed obliquely forwards.

The right and left branches of the superior longitudinal sinus, called the *lateral sinuses*, which are imbedded in the grooves of the occipital and temporal bones, follow a tortuous course, and at length terminate in the internal jugular vein.

The fourth sinus or Torcular Herophili, is a short canal, situated at the junction of the falx and tentorium, which it passes, downwards and backwards, and joins the lateral sinuses.

The inferior longitudinal sinus, lodged in the under part of the falx, is very small when compared with the upper, and is sometimes awanting.

The Arachnoid Coat.

The term *Arachnoid* has been applied to this coat on account of its extreme thinness, and resemblance to a spider's web. At the base of the brain, this coat may be easily detached from the other membranes. On account of the extreme thinness of the membrane, it is difficult to detect its structure. I am inclined to suppose it a serous membrane; for it is subject to the same organic derangements as membranes of that description.

There are no vessels proper to this coat, which are of such a size as to admit the red blood.

This membrane does not enter between the convolutions of the brain or cerebellum.

Of the Pia Mater.

The third membrane of the brain, called *Pia Mater*, is thin and very vascular; and from it, many bloodvessels pass into the substance of the brain.

This membrane enters between the convolutions of the brain; and those processes or elongations have been called the *Tomenta Cerebri.* The pia mater also gives a lining to the ventricles of the brain.

The pia mater receives its blood from the internal carotid and vertebral arteries.

Of the Brain.

The *Brain*, properly so called, which occupies the upper part of the cavity of the cranium, corresponds in figure to the skull, to which it gives form.

The upper part of it is generally of an oval figure like an egg, cut lengthwise.

It is composed of two portions, called by anatomists *Hemispheres*, which are separated from each other by a deep fissure which receives the falx; and each of which is subdivided into lobes.

Each *hemisphere* is arched above, irregular beneath, and flat next the falx, and subdivided into *three lobes*. The anterior lobe rests upon the orbitar process of the frontal bone; the middle lobe, which is separated from the anterior by the FOSSA SYLVII, occupies the cavity formed by the sphenoid and temporal bones; and the posterior lobe rests upon the tentorium cerebello superextensum.

The surface of the brain is not uniform; there are on it numerous convolutions, in the grooves between which the pia mater and small vessels of the brain are lodged.

The under surface of the brain is much more irregular than the upper one, consisting of a number of prominences.

The brain, when divided by an incision, is found to be neither uniform as to colour nor consistence. The outer part of it is somewhat of a colour resembling burnt wood; soft and very vascular; but internally white or medullary, as anatomists speak, though improperly, as this part of the brain is not like marrow.

In the section of the medullary part of the brain, a number of red points, or the orifices of cut vessels may be perceived; and upon examining with attention the medullary matter, a number of *fibres*, disposed in different directions, may be perceived, and more especially by the aid of magnifying glasses.

The falx cerebri divides the brain only to a certain extent. Upon removing it, a broad white medullary plate, extending horizontally across the brain, and which unites its hemispheres, presents itself: this has been named, from its white and hard appearance, *Corpus callosum*.

A horizontal section of the hemispheres of the brain, made on a level with the corpus callosum, exposes the greatest proportion of medullary to the cineritious substance, and the medullary substance assumes an oval shape. We thus form what has been called the *Centrum ovale of* VIEUSSENS.

There is a groove or raphè extending longitudinally along the corpus callosum, and on each side of it a medullary chord, from which many transverse fibres proceed.

On cutting down on each side of the corpus callosum, we get into two oblong cavities, placed horizontally, and which Baron HALLER has named, on account of their figure, *Ventriculi tricornes*, each of them having three cornua.

The anterior and posterior cornua of the lateral ventricles, are placed nearly horizontally; the middle cornua descend, and then run forwards into the middle lobes of the hemispheres.

By a vertical section, the corpus callosum is found to be bent downwards at its anterior and posterior parts; the continuation of which latter forms what anatomists have called the *Fornix*, from its resemblance to a vault.

Between the corpus callosum and fornix, the *septum*, called *lucidum*, is placed, which is narrow before, becomes gradually broader, and is composed of two plates of medullary substances. The fornix has four crura or pillars, two anterior and two posterior; and the latter are the larger, and descending into the inferior cornua of the lateral ventricles, form distinct processes, which have thin puckered edges, and have been called the Corpora fimbriata.

The under part of the fornix is joined to the Thalami Nervorum Opticorum, by a membrane called *Tela choroidea.* There is an oval aperture of communication between the lateral ventricles of the brain and the third ventricle, which has been described by my Father, in his book on the Ner-

vous System, and also in his Treatise on the Brain, published in 1797 *.

The under surface of the fornix is impressed by a number of grooves, disposed somewhat like the strings of a lyre.

Upon the fornix being removed, a vascular web is exposed, which envelopes the Corpora quadrigemina. The lateral ventricles being fully exposed, the following parts come into view.

In the anterior cornu of each lateral ventricle, there are two very obvious projections, the Corpus Striatum, and Thalamus Nervi Optici. The corpora striata, are pyriform bodies, broad before, and narrow behind; and being composed partly of cineritious, and partly of medullary matter, exhibit, when divided, a striated appearance.

The Thalami Nervorum Opticorum intervene between the posterior parts of the corpora striata, and are of a whiter colour than the corpora striata.

* "An oval hole, situated under the anterior part of the body of the fornix; behind the anterior crura of the fornix and commissura anterior cerebri; on the fore-part of the joining of the choroid plexuses of the two lateral ventricles of the brain; and over the fore-part of the third ventricle. Hence, at this place, the lateral ventricles of the brain communicate with each other and with the third ventricle."—*Treatise on the Brain, the Eye, and the Ear*, p. 22.

The thalami nervorum opticorum of the corresponding lateral ventricles, are united by a soft transverse plate of medullary substance, called the *commissura mollis.*

Under the commissura mollis, there is a deep fissure between the thalami nervorum opticorum: this is the third ventricle; and from it, the funnel-like cavity, called *infundibulum,* runs downwards and forwards to the pituitary gland.

The pituitary gland, is a small oblong-shaped body, inclosed by the dura matter, and situated in the sella sphenoidalis: it is greyish without, and medullary within.

There is a transverse medullary chord immediately before the anterior crura of the fornix, which runs through, and unites the corpora striata, called *anterior commissure;* and at the posterior part of the third ventricle, under the root of the pineal gland, there is a similar, though rather shorter chord, called the *posterior commissure.*

In each lateral ventricle, there is a plexus of small arteries and veins, called the *choroid plexus.*

The choroid plexuses are expanded upon the thalami nervorum opticorum, pineal gland, and corpora quadrigemina.

In each plexus, there is a large venous trunk, which is directed backwards; and the venous trunks of the corresponding choroid plexuses, unite behind the pineal gland, and their contents are discharged into the torcular Herophili.

In the descending cornua, besides the posterior crura of the fornix, there are two rounded bodies,

which are joined to the posterior extremity of the corpus callosum ; these are small at their origin, and become considerably larger, and have been called *pedes hippocampi.* The posterior cornua of the lateral ventricles, are reflected towards each other ; and in the extremity of each, there is a sharp point, called *ergot.*

Upon removing with care the choroid plexus, *the corpora quadrigemina,* or *nates* and *testes,* appear at the back of the third ventricle.

From the third ventricle, there is a passage into the fourth ; and over this passage, the nates and testes, or tubercula quadrigemina are placed, and also the pineal gland.

The glandula pinealis, is a rounded body situated over the nates, and fixed to the posterior commissure, and by two long processes to the inner side of the thalami and anterior crura of the fornix.

In the centre of this gland, there is often a hard sandy substance ; the proportion of which varies in different cases.

Under-Surface of the Brain and Cerebellum.

In the under surface of the brain, there are four eminences corresponding with the cavities in the base of the skull, viz. the anterior lobes of the brain, the middle lobes of the brain, the inferior surfaces of the cerebellum, and the pons VAROLII ; and between these, there is a deep depression, in

which the infundibulum, pituitary gland, corpora albicantia, and optic nerves, are situated.

SECT. II.

OF THE CEREBELLUM.

THE cerebellum occupies the inferior cavities of the occipital bone, and is placed below the posterior lobes of the brain *.

The cerebellum is in form and size very different from the cerebrum; and in different animals bears a different proportional size to the brain.

It is rather flattened above, rounded below, and proportionally much broader than the brain, and it presents a laminated surface; between which, the pia mater insinuates itself. It has the same coats as the brain.

Like the brain, it is divided into *two great lobes*, or *hemispheres*, each of which is subdivided into *lobules*.

In the cerebellum, there is a greater proportion of cineritious substance, than in the brain; and the medullary matter seems, when the cerebellum is cut vertically, to be distributed through it, somewhat like the branches of a tree.

* GALL's views of the relative situation of the cerebellum, in respect to the brain, and of the appearance of the surface and intimate structure of the cerebellum, are by far the best which have been hitherto published.

There are two small eminences, which have been named *appendices vermiformes*, from their resemblance to worms; one of which is placed on the anterior and superior part of the cerebellum, the other on its inferior and posterior part.

The cerebellum is joined to the cerebrum by two medullary chords, which are inserted into the substance of the cerebellum, and their fibres are intermixed with those of the medulla oblongata.

There is a ventricle, the *fourth*, placed between the cerebellum, pons Varolii, and upper part of the medulla oblongata, and which extends from the testes to the posterior part of the cerebellum.

In the under-part of the fourth ventricle, there is an angular impression, which has been supposed to bear a resemblance to a writing-pen, and is hence named *calamus scriptorius*. This ventricle is shut by its *choroid plexus*.

SECT. III.

TUBER ANNULARE, OR PONS VAROLII.

THE tuber annulare, can only be well seen by inverting the brain. It is formed by the union of four columns, the crura cerebri and cerebelli, which form a sort of bridge; and this in its centre is somewhat depressed.

The tuber is situated upon the back-part of the body of the sphenoid and cuneiform process of the occipital bone.

From the tuber annulare, the Medulla oblongata, which resembles a cone, with its base next to the tuber annulare, takes its rise: it extends to the foramen magnum ossis occipitis; and upon the surface of the medulla on each side, there are two eminences disposed longitudinally; the one like an olive, the other like a pyramid; hence the terms *corpora pyramidalia* and *olivaria.*

Sect. IV.

OF THE ARTERIES OF THE BRAIN.

The brain is supplied with blood from four different sources, by the vertebral and internal carotid arteries: These arteries follow a tortuous course before entering the brain, in order that the blood may not be sent with too great force to that delicate and important organ; and they communicate frequently and freely with each other.

Sect. V.

OF THE VEINS OF THE BRAIN.

The veins of the brain do not follow the same course as the arteries: they lead to the venous sinuses, enveloped by the dura mater, which are so constructed, and so situated, that they can neither be over-distended nor compressed.

Sect. VI.

OF THE NERVES CONNECTED WITH THE BRAIN.

The nerves have been divided into two great classes, viz. those said to be connected with the brain, which have been named the *cerebral nerves*, and those connected with the spinal marrow, called *spinal nerves*.

Nine or ten pairs of nerves are described by anatomists, as taking their origin from the brain, besides the sympathetic nerve; and twenty-nine or thirty pairs of nerves from the spinal marrow, besides the accessory nerves.

But from what has been above stated, it follows, that the term *origin* is incorrect, *as the brain might as well be said to arise from the nerves, as the nerves from the brain.*

It may be further observed, that anatomists differ very much in their statements, respecting the particular part of the brain or cerebellum, from which the nerves are said to originate; it being very difficult to trace a nerve to its real source from the medullary matter of the brain or cerebellum; for they sink deep into the substance of the brain, and the fibres probably are intimately intermixed with those of other nerves.

Soemmering supposed, that the roots of the nerves, especially of the nerves of the organs of

the senses, reached the prominences in the parietes of the ventricles of the brain *.

I 4

* The Plates of the brain of Drs GALL and SPURZEIN, are, taken as a whole, far superior to any that have been published; and by their method of exhibiting the brain, they have thrown much light upon the relative situation of parts.

Their 6th Plate exhibiting the ventricles of the brain, seems to be peculiarly worthy of attention; as also Plate 10th, in which a vertical section of the brain is given.

The above engravings also exhibit more distinctly than those of VIEUSSENS, my FATHER, or VICQ D'AZYR, the continuity of the fibres which extend from the medulla oblongata into the hemispheres of the brain and cerebellum, and also the decussation of the filaments of the corpora pyramidalia, which have been described by SANTORINI.

Drs GALL and SPURZEIN have discovered two different kinds of fibres in the medullary substance of the hemispheres of the brain; the one of which diverges from the peduncles of the brain, and the other converges towards the commissures.

The same distinguished authors agree with my Father in opinion, that the nerves do not take their origin from the brain.

I cannot refrain from adding, that their opinion respecting the unfolding the brain somewhat like a membrane, seems to be extremely doubtful; and also, that it is not a little remarkable, that those gentlemen who have devoted so much attention to the anatomy of the brain, should not have understood the descriptions and Plates my Father has published respecting the communication between the lateral ventricles of the brain, to which they have repeatedly referred. They seeem to have looked for that passage of communication between the lateral ventricles of the brain in the septum lucidum, where they did not,—could not have found it, and therefore have denied its existence.

MOREAU, on the other hand, the learned editor of the last edition of VICQ D'AZYR's book on the Brain, speaking of the communication between the ventricles, has observed, " Les

SECT. VII.

OF THE PHYSIOLOGY OF BRAIN.

THE brain is the seat of the intellectual faculties

ouvertures qui établissent la communication des ventricules latéraux avec le troisième, sont décrites dans l'ouvrage publié par MONRO, en 1783. Cet anatomiste célèbre en a donné plusieurs dessins exacts, et il a fait voir combien ces ouvertures sont augmentées par certaines dispositions morbifiques, et principalement par les amas d'eau dans les cavités cérébrales."

As the reader may possibly be gratified by a brief summary of the opinions of Drs GALL and SPURZEIN, respecting the anatomy of the brain and nerves, I have subjoined, in their own words, the corollaries they have published on that subject:

Corollaires anatomiques.

1. L'ensemble du système nerveux ne présente que deux substances: l'une gélatineuse dont la couleur varie, mais le plus souvent est grise; l'autre blanche et fibreuse, ou les filamens nerveux; par conséquent il n'existe pas de véritable substance médullaire.

2. La substance gélatineuse grise, engendre les filets nerveux; ceuxci ne naissent d'aucune autre manière, par exemple, par la métamorphose des vaisseaux sanguins, ou immédiatement de la lymphe du sang.

3. Plus la substance gélatineuse est abondante, plus elle engendre de filets nerveux; par conséquent la quantité de substance grise et le nombre des nerfs sont en raison directe et réciproque.

4. Aucun nerf ne naît d'un autre nerf; mais chacun prend son origine dans une masse propre de substance gélatineuse;

It forms an important part of the nervous system, the general functions of which I have endeavoured to explain.

Much labour has been bestowed by anatomists and philosophers to distinguish the purposes of the particular processes of the brain; but as yet they have made little progress in their investigations.

par conséquent les systèmes nerveux de la poitrine et du bas-ventre ne peuvent être dérivés ni l'un de l'autre, ni médiatement du cerveau, ni immédiatement de la moëlle épinière.

5. Les systèmes nerveux diffèrent entre eux dans leur origine, leur structure, leur couleur, et leur fermeté.

6. Le nombre des divers systèmes nerveux, par exemple, les systèmes des viscères, de la moëlle épinière, varient dans les différens animaux.

7. Les mêmes systèmes partiels sont diversement modifiés dans les différentes classes d'animaux, et ne sont pas toujours développés d'une manière semblable dans les individus de la même espèce.

8. Les différens individus de la même espèce n'offrent jamais exactement le même rapport entre les conditions des divers sytèmes nerveux.

9. Les ganglions et les plexus ne diffèrent pas essentiellement; car les uns et les autres engendrent des nerfs; ou bien ils renforcent par de nouvelles productions les nerfs déjà existans.

10. Tous les systèmes nerveux sont unis les uns aux autres par des branches de communication. Ainsi les divers systèmes de la moëlle épinière sont unis par des rameaux communiquans, ces rameaux ne doivent pas être considérés comme des cordons qui composent l'ensemble de la moëlle épinière.

11. Les divers systèmes nerveux ne se développent pas simultanément; les uns sont formés plutôt, les autres plus tard; de même qu'ils diminuent à des époques différentes.

CHAPTER III.

OF THE ORGANS OF THE SENSES.

THE external senses, are those of *Smell, Vision, Hearing, Taste* and *Touch;* to each of which, organs of a peculiar structure are appropriated, and which are susceptible only of particular impressions.

SECT. I.

OF THE NOSE.

THE *Nose* is formed of hard and soft parts.

The nose has been divided by anatomists into the radix or upper part; the dorsum or middle prominence; the apex or point. The os frontis, ossa nasi, and ossa maxillaria, form the upper and fore-part of the nose. The os ethmoides, and the ossa unguis, form the upper and lateral parts of the nose. The ossa spongiosa inferiora, os sphenoides, ossa palati, ossa maxillaria superiora and

vomer, constitute the under, inner and back part of the nose.

The internal nares are two cavities placed between the external nares and the posterior openings of the nose into the throat.

The turbinated processes of ethmoid bone, and the ossa turbinata inferiora, project into the cavities of the nose, and add much to the extent of the internal surface of the nostrils.

In quadrupeds that smell very acutely, the internal surface of the nose is very much extended by the complex structure of the turbinated bones.

Three passages into the nose have been described by HALLER; an upper passage above the turbinated processes of the ethmoid bone; a passage between the turbinated processes of the ethmoid bone and inferior spongy bones; and a passage below the inferior turbinated bones; and this passage being straight, a probe may readily be passed along it into the throat.

The septum narium is composed of the descending plate of the ethmoid bone, of the vomer, and cartilage.

The soft parts of the nose are; its cartilages, ligaments, membranes, muscles, and skin. There are five cartilages of the nose; the largest of which, the basis on which the lateral cartilages rest, is placed in the middle.

The middle cartilage, also, forms a considerable share of the septum narium; and is fixed to the vomer; to the spinous process of the ossa maxil-

laria superiora; and to the anterior part of the asal lamella of the ethmoid bone.

The anterior lateral cartilage is bent forwards, and forms what is commonly called the *tip of the nose*, and the posterior form the wings of the nose.

These cartilages are covered by cellular membrane, fat, a number of sebaceous glands, by skin, and by the following muscles, by which they are moved, viz. by the compressor narium, and part of the occipito-frontalis, which is fixed into the nose, and by the levator and depressor labii superioris alæque nasi.

The nose is lined by a spongy and very vascular membrane, which is constantly lubricated by mucus, which exudes from a number of pores on the surface of this membrane.

This membrane is not of an uniform thickness, being thinner at the external nares.

In the fore-part of the nostrils, there are a number of hairs.

The nose is supplied with nerves by the first or olfactory pair of nerves, and by the fifth pair.

The olfactory nerves take their rise by three roots from the corpora striata, situated in the anterior cornua of the lateral ventricles: they are flattened; are disposed in grooves in the under part of the anterior lobes of the brain, and approach each other as they pass forwards; and thus terminate in an oval-shaped body, which rests upon the cribriform plate of the ethmoid bone.

From these oval-shaped bodies, a great number of small nerves pass through the holes in the cribriform plate. These nerves divide into two fasciculi; the one set is distributed upon the septum narium, upon which they form a very intricate plexus. My Father was, I believe, the first who accurately described the course of these small nerves.

The other part of the olfactory nerves is distributed upon the turbinated processes of the ethmoid bone.

The ethmoidal, sphenoidal and frontal sinuses, communicate with the nose, and are lined by the continuation of the membrane which lines the nostrils.

The frontal communicate with the ethmoidal sinuses, which communicate with the nose at its upper and lateral parts behind the os unguis.

The sphenoidal sinuses open into the upper and back part of the nose, and the maxillary sinuses communicate with the nose by an aperture placed nearly in the middle between the turbinated processes of the ethmoid bone and the inferior turbinated bones.

The air, the vehicle of all odours, when impregnated with certain odours, and inhaled, excites the sensation we call smelling; and to render the sensation the stronger, the internal surface of the nostrils is of very considerable extent; and in gene-

ral it may be observed, that the more complex the structure of the nose, the more acute the sense of smell is.

The sinusus which communicate with the nose, tend to render the voice louder and more melodious.

CHAPTER IV.

OF THE EYE AND ITS APPENDAGES.

The eye-ball is composed of coats which contain certain *Humours*, calculated for collecting the rays of light into a focus, upon the nerve situated at the bottom of the eye-ball.

The eye-ball somewhat resembles a sphere; from the fore-part of which there is a convex prominent clear body, called the *Cornea*.

SECT. I.

OF THE COATS OF THE EYE-BALL.

The eye projects more beyond the outer than the inner side of the orbit.

Three coats have been enumerated, as being proper to the eye-ball; and there is a fourth, by which it is retained in its proper place, called *Tunica adnata.*

The *tunica adnata* is merely a reflection of the skin from the eye-lids, which extends over the eye-ball, serving to fix it in its place, and to prevent extraneous bodies from passing from the fore to the back part of the orbit.

A small quantity of cellular substance intervenes between this coat and the white of the eye.

The *tunica sclerotica*, an opaque, white, elastic, dilatable, fibrous membrane; is of unequal thickness; has few vessels on it, derived from the ciliary arteries; and possesses little sensibility. This coat surrounds the whole ball of the eye, excepting that part of the ball occupied by the cornea.

This coat is tough and strong, and well calculated for determining the shape of the eye, and for supporting and defending the more delicate and more useful parts of that organ. The tendons of the muscles which move the eye-ball are fixed to the sclerotic coat.

The Cornea which forms the convex transparent part of the eye-ball, consists of many thin plates, united by cellular substance; and these, when united, form one plate, which is thickest in the centre. The cornea is covered by the thin edge of the tunica sclerotica.

The cornea, which is more or less convex in different individuals, and in different animals, is not exactly circular.

When the cornea is too convex, the rays of light are collected into a focus before the retina, and such persons are short-sighted; but, on the other hand, when the cornea is flatter than common, the foci of rays proceeding from near objects are formed beyond the retina, and such persons are long-sighted, and can only see objects held at a considerable distance from the eye.

In the healthy eye, there are no vessels on the cornea capable of receiving red blood.

The cornea has been supposed to have a great effect in refracting the rays of light; because the rays at the cornea pass from the rarer medium, the air, into the more dense medium the aqueous fluid.

Of the Choroid Coat.

The Choroid Coat is much thinner than the sclerotic; of a brown colour; internally villous; largely supplied with bloodvessels and nerves; and connected to the sclerotic only by fine cellular membrane, by bloodvessels and nerves, excepting at its fore part near to the iris, where these coats are connected by the ciliary ligament.

The brown colour of this coat is derived from the paint which covers its surfaces, shining through

it; and this paint, which is thicker and darker coloured in the Negro than in the European, is of a very peculiar nature, and is not altered by heat, by immersion in spirits, or by chemical tests.

Nearly opposite to the ciliary circle, there is a dark-brown radiated circle, about one-sixth of an inch broad, called *Corpus ciliare*; and near to the root of the iris, the choroid coat is folded into sixty or seventy folds, which are lined by dark paint. The dark paint of the choroid coat serves to prevent the reflection of light, and the formation of a second image.

The *nerves*, called *Ciliary*, which are flat, may be observed passing along the surface of this coat, accompanied by the long *ciliary arteries*, and the ramifications of the shorter ciliary arteries, also the smaller accompanying veins, which, from following a vorticose course, have been called *Venæ vorticosæ*.

Ciliary Ligament, or Ciliary Circle.

The ciliary ligament is composed of dense cellular membrane, and appears as a grey ring, which connects the choroid coat and margin of the iris to the sclerotic coat.

This ligament has been stated by SOEMMERING to be composed chiefly of the ciliary nerves and of bloodvessels.

A triangular canal has been described by FONTANA, SOEMMERING and MURRAY, as running

along this ciliary ligament, and as being partly formed by the groove at the edges of the cornea and sclerotic coat.

Of the Ciliary Processes.

The ciliary processes are mere doublings of the choroid coat, the extremities of which hang loose in the aqueous humour.

The ciliary processes are chiefly composed of a plexus of vessels; they are not muscular, and there is no reason to suppose that they compress the lens.

SECT. II.

OF THE OPTIC NERVE AND RETINA.

THE optic nerves are commonly said to arise from the thalami nervorum opticorum*: they are of a large size, whiter than the other nerves; are covered by the dura and pia mater; are connected to one another at the fore-part of the sella sphenoidalis.

* Several anatomists, as WINSLOW, ZINN, SANTORINI, GIRARDI, GALL and SPURZEIN, are of a contrary opinion, and have affirmed, that these nerves take their rise from the Nates and Testes. In proof of which, the last-mentioned authors have remarked, that when the optic nerve of one side is smaller than the other, the corresponding tubercles are also smaller.

The Optic Nerve describes a tortuous course in the orbit, and is contracted where it enters the sclerotic coat, in which there are a number of small holes.

The optic nerve enters the eye-ball rather nearer to the nose than the axis of the eye-ball; and is expanded into a very delicate pulpy substance, which is nearly transparent in the eye immediately after death, called by anatomists *Retina*. The retina consists of a thin plane of medullary matter, which extends as far forwards as the greater diameter of the capsule of the crystalline lens, between the choroid coat and capsule of the vitreous humour *.

The retina is not of an uniform thickness; it is considerably thicker at its posterior than at its anterior part.

The retina is very thin, especially under the ciliary processes, to which it is glued, and by which it is impressed, so as to have a striated appearance.

Some anatomists are of opinion, that the retina is not an expansion of the optic nerve; 1st, Because, upon making a section through the optic nerve, it may be observed rather to be contracted than expanded; 2d, Because in some animals there is a projection of the optic nerve, and no connection is said to exist between it and the retina, as in the haddock.

* Vid. Plate xli. fig. 1.

The axis of the eye-ball does not correspond with that of the orbit. The axis of the orbit is directed obliquely outwards, whereas the axis of the eye is directly forwards; and the axes of the two eyes are parallel.

That part of the optic nerve which enters the eye-ball is insensible. My Father has observed: "I found that the diameter of the object which disappears is very nearly equal to one-ninth part of our distance from it; or, that, at the distance of nine feet from a wall, a circle one foot in diameter is lost. If, therefore, we suppose the human eye to be one inch or twelve lines in diameter, and that the rays of light, issuing from the object, decussate about the centre of the crystalline lens, which is nearly three lines behind the cornea, or nine lines from the retina,—the insensible spot on the bottom of the eye will be one line in diameter; and with this calculation, I found that the actual measurement of the medullary part of the optic nerve agrees very nearly.

"I next found, that an object begins to disappear, when the point to which the eye is directed, is one-fourth of the distance of the eye from it; and hence, upon the supposition above stated, the axis of the eye-ball will be found to be two lines and a quarter from the outer side of the optic nerve, and two lines and three quarters from its centre *."

* Treatise on the Brain, &c. p. 92.

In the axis of the eye, there is a small aperture, called by its discoverer SOEMMERING, *Foraminulum*, in the retina, which is encircled by a yellow border, the use of which is unknown.

There are a number of small arteries distributed upon the inner surface of the retina, which are derived from the central artery of the optic nerve.

SECT. III.

OF THE IRIS OR MOVEABLE CURTAIN.

THE iris floats in the aqueous humour; is of different colours in its fore-part in different individuals, corresponding with the colour of the hair, being light blue or grey when the hair is light, and brown or black when the hair is black. The iris or moveable curtain, is placed behind the cornea, and is calculated to prevent too much light from reaching the bottom of the eye.

In the centre of the iris, there is an aperture called *pupil;* the size of which varies according to the degree of light to which the eye is exposed. On the posterior part of the iris, there is a dark-coloured mucous matter, which may be readily washed off, which was called by the older authors *uvea*, from its supposed resemblance to a grape in colour. Upon the paint being washed of, two sets of fibres come into view; one set is concen-

tric around the pupil; the other set issues from the pupil, as from a centre, to the circumference of the iris.

The iris, according to my Father, is a muscular organ. "Its appearance is, in all respects, so evidently muscular, that I think there can be no doubt of its being the sphincter of the pupil: And I can only account for its having escaped the observation of Dr HALLER and Dr WRISBERG, by supposing that they had not washed off the black paint, which covers and conceals it, as well as the red vessels of the iris.

"On the inner and anterior part of the iris, and on the whole of its posterior part, the fibres are disposed like radii; and, if they are muscular, they are well situated for dilating the pupil. But these have many more blood-vessels in their composition, and have much less the appearance of muscular fibres, than the oval fibrous organ I have described on the fore-part of the iris.

"My success in the ox naturally prompted me to examine the human iris with greater attention than I had formerly bestowed on it; and in this I found, with equal satisfaction, a very distinct sphincter muscle; but somewhat differently disposed; for in man it occupies the innermost part of the iris, or forms a ring immediately surrounding the pupil, which is equally well seen on its fore and back parts, and makes about one-fifth part of the breadth of the iris. Between the

sphincter and root of the iris, the space is filled up with vessels and radiated fibres *."

The iris divides the aqueous humour into two chambers, an anterior and a posterior: the anterior is placed between the posterior surface of the cornea and the anterior part of the iris.

The posterior chamber is situated between the posterior surface of the iris and the anterior part of the crystalline lens.

The iris receives its blood by the long ciliary arteries.

The long ciliary arteries which supply the opposite sides of the iris freely anastomose with each other; and the smaller vessels of the iris form a circle around the pupil.

The iris is supplied with nerves by the branches of the ciliary nerves; and these are large and numerous, in proportion to the bulk of the organ.

The motions of the iris are involuntary, and depend on the quantity of light which falls on the retina; for light falling on the iris itself produces no motion. Upon examining a minute object, the pupil is contracted, to exclude the most divergent rays of light, which could not be united upon the retina. But in some animals, as the parrot, the movements of the iris are voluntary.

* Treatise on the Brain, &c. p. 111, 112.

SECT. IV.

OF THE HUMOURS OF THE EYE.

Of the Aqueous Humour.

THIS humour in the adult is remarkably pellucid, in order that the light may readily be transmitted through it, but in the fœtus frequently turbid; and according to CHENEVIX, consists of jelly, albumen, water and muriate of soda.

Different opinions have been entertained respecting the source of this humour.

This humour is very quickly regenerated.

The aqueous humour is contained within the two different chambers; the anterior or larger, is placed between the cornea and iris; and the posterior between the iris and crystalline lens.

By this humour, the cornea is distended, so as to assist in collecting the rays of light.

The aqueous humour also serves as a defence to the iris and crystalline lens.

Of the Crystalline Lens.

This humour has been called *Crystalline Lens,* being transparent like crystal, and in its form like a double convex lens. It is placed behind the pu-

pil, and its posterior part is imbedded in the vitreous humour.

The human crystalline lens varies in colour and figure at different periods of life: in the fœtus it is reddish, and nearly spherical; in middle life, transparent, and in figure like a double convex lens, which is more convex behind than before; but in old age it frequently acquires a topaze colour, and becomes much firmer than at a more early period of life.

The crystalline lens is a soft tender substance, of unequal density; in the centre, it is firmer, tougher and heavier, than in its circumference; and hence possesses a more equable refractive power than any artificial lens. My Father, in his Treatise on the Eye, has observed: "It has been very generally supposed, by anatomists and by opticians, that the refractive power of the crystalline lens, compared with that of water, is proportioned nearly to its density; or, that its power exceeds that of water somewhat, on account of the inflammable matter which enters into its composition *. But different considerations, and parti-

* HALLER, in Elem. Phys. vol. v. lib. xvi. p. 402. "Parvam esse qua aquam superat, prærogativam, nuperi fatentur. Erit tamen aliqua, et ex ponderis ratione, quæ tamen fere sit ut 11 ad 10, et particularum inflammabilium. Angulum incidentiæ radii ex humore aqueo in lentem venientis, ad angulum refractionis, facit uti 87 ad 85, cl. PORTERFIELD: Eandem rationem æstimat cl. PEMBERTONUS, uti 13 ad 12; et uti 21 ad

cularly, that the rays of light cannot be refracted on entering the cornea in fishes, and therefore that their crystalline lens, which is not more distant from the retina than in land animals, must possess much greater power of refraction,—having led me to suspect an error in the common opinion, and to put this highly curious point of physiology to the test of experiment, I discovered, That the spherical nucleus of the crystalline lens of the cod, which, in specific gravity, is to water nearly as 6 to 5, and to common white glass as 3 only to 10, collects the light so much more powerfully than water or glass does, that its focus is not more than one-sixth part of its diameter distant from its surface; whereas the focus of the rays collected by a glass sphere, is at the distance of one-fourth of the diameter of the sphere; and the focus of the rays collected by a sphere of water, is distant from it one-half of its diameter.

"On performing a similar experiment with the human crystalline lens, I found, that the focus, of parallel rays of light falling on it, is at the distance of three-eighths of an inch from its centre.

"But, although this shews, that its powers are far inferior to those of the lens of the fish, and

20, cl. WINTRINGHAM." And Dr PORTERFIELD adds, "This is a surprisingly small refraction, and yet it is as certain as any thing in Euclid, that it can be no greater."

even to those of glass, which, of the same size and shape, would collect the light at the distance of a quarter of an inch *; yet, as the specific weight of the human lens does not exceed that of water above a tenth part, its powers are much greater than have been supposed by authors; and the focus formed by the human lens, will be found to be situated, nearly, half-way between those produced by glass and water †."

The lens is composed of a number of concentric layers, united to each other by cellular substance.

These layers may be disunited, by putting the lens into boiling water, or into an acid.

When the lens has been steeped for some time in water, its component layers assume a radiated appearance.

There is no reason to suppose, the fibres which compose the lens to be muscular, or to possess the property of changing the form of the lens; and if the lens had been muscular, the contraction of the centre of the lens, must have occasioned the laceration of the external part of the lens.

The crystalline lens is contained in a pellucid and elastic capsule, which is thinner behind than

* "In this calculation, I suppose that the radius of the sphere of which the anterior part of the lens is a portion, is 7½ lines in length, and that of its posterior part 5 lines only."

† Treatise on the Brain, &c. p. 87,—89.

before, and this capsule adheres but slightly to the body of the lens; a small quantity of water being said by most authors to be interposed.

The lens may be readily detached by slight pressure after puncturing it.

There are no vessels either upon the capsule or body of the lens in the adult, of such a size as to admit the red globules of the blood.

Of the Vitreous Humour.

This transparent humour, which, in colour and consistence, bears a strong resemblence to the glaire of an egg, is contained in a very thin capsule, named *tunica hyaloidea*.

Besides the general capsule, there are septula passing across the vitreous humour, which communicate with each other.

According to Mr CHENEVIX, this humour consists of water, albumen, jelly, and muriate of soda, and its specific gravity is 1.0053.

This humour occupies the greater share of the ball of the eye, and keeps the retina at a proper distance from the bottom of the eye.

The capsule of the vitreous humour, divides at the fore-part, into two layers. "Within the roots of the ciliary processes, it adheres closely to the retina; and, a little farther forwards, it seems to

divide into two distinct layers. The external continues to be glued to the retina, and accompanies it to its termination, which we shall find to be in the fore-part of the capsule of the crystalline lens, about one-twentieth of an inch from its outer edge: The internal layer adheres firmly to the vitreous humour, till this is connected with the posterior part of the capsule of the lens, at the like distance, nearly, of one-twentieth of an inch from its outer edge; and, at the distance, therefore, of one-tenth of an inch from the connexion of its anterior layer and retina with the lens. The outer edge, therefore, of the crystalline lens, covered with its proper capsule only, occupies a space nearly one-tenth of an inch in breadth, between the two layers of the capsule of the vitreous humour.

"The anterior layer of the capsule of the vitreous humour being fixed to the crystalline lens, at the distance, nearly, of one-tenth of an inch from the attachment of its posterior layer,—a canal, bounded by the two layers of the vitreous humour, and by the edge of the crystalline lens, as its basis, is formed, which was discovered by Dr Petit, and is named after him *. Air, blown into this space, passes, of course, around the crystalline lens †. Each of the two layers of the capsule of the vitreous humour, is tougher than the posterior part

* Mem. de l'Acad. des Sciences, 1726.

† Vid. Plate xli. fig. 1.

of the capsule, and adheres firmly to the capsule of the lens *."

Between the layers of the capsule of the vitreous humour, there is a canal, which, owing to its transverse fibres, resembles, when inflated, the colon.

SECT. V.

BLOODVESSELS OF THE EYE.

THE bloodvessels of the contents of the orbit are derived from the internal carotid, internal maxillary, frontal, facial, and temporal arteries.

The ocular artery, a branch of the internal carotid, passes through the foramen opticum, beneath the optic nerve, and sends off a number of small branches, which perforate the sclerotic coat, which have been called *ciliary arteries*; and which are distributed upon the choroid coat and iris.

SECT. VI.

CONCLUSIONS.

FROM what has been stated respecting the structure of the eye, it follows that the rays of light

* Treatise on the Eye, &c. p. 79.

proceeding from an object, and which diverge as they advance, are collected by the humours of the eye, and especially by the crystalline.

The cone of rays, of a luminous body, forms, after passing through the crystalline lens, a second cone, the apex of which falls on the retina.

The rays of light, which are perpendicular to the middle of the lens, proceed directly to the retina; those on the left proceed to the right, and so on with the other rays; hence the image formed on the retina, is inverted.

In the above very general account of the structure of the eye, I have not endeavoured to describe the form, proportion, or refractive powers of the transparent parts of the eyes, nor the radii of their curvatures, because the limits of these Outlines prevent me from entering more at large into the physiology of the several parts of the eye.

Sect. VII.

MUSCLES OF THE EYE-BALL.

There are six muscles which move the eye-ball; five of which take their origin from the sides of the foramen opticum, and have been named from their direction, or apparent action,

The *sixth muscle*, the inferior oblique, takes its rise from the fore-part of the orbit.

These muscles which have been called *straight* and *oblique muscles*, are not exactly so, on account of the shape of the orbit.

The above muscles terminate in broad thin tendons, which are inserted into the sclerotic coat under the tunica adnata, about one-sixth of an inch from the cornea.

By the straight muscles, the axis of the eye is directed towards different points; and by their combined action, the eye-ball is directed towards any intermediate point, or in a circle by the successive action of these muscles.

Rectus Superior, or *Levator Oculi*.

This muscle passes nearly horizontally below the levator palpebræ superioris and optic nerve; it is the thinnest of the recti muscles, and takes its rise from the upper part of the foramen opticum, and is fixed into the sclerotic coat, about one-fifth of an inch from the edge of the cornea.

By this muscle, the eye-ball is raised.

Rectus Inferior, or *Depressor Oculi*.

This muscle is situated in the lower part of the orbit, and takes its rise from the lower part of the

foramen opticum, and fixed opposite to the insertion of the former muscle into the sclerotic coat.

By the above muscle, the fore-part of the eye-ball is depressed.

Abductor and Adductor Oculi.

The eye-ball is provided with an ABDUCTOR and ADDUCTOR muscle, the former of which arises from the inferior and posterior part of the fissure of the orbit, and is fixed into the eye-ball opposite to its outer angle; the latter the shortest, thickest and straightest of the recti muscles, arises from the side of the foramen opticum, and is inserted opposite to the inner angle of the eye.

By the *abductor*, the eye-ball is pulled towards the temple; by the adductor, towards the nose.

Obliquus, Superior and Inferior.

The former arises from the side of the foramen opticum; its tendon included within a bursa, passes through a cartilaginous pully, fixed behind the internal angular process of the os frontis; it afterwards is reflected under the levator oculi, and is fixed into the sclerotic coat between the insertion of the levator oculi, and entrance of the optic nerve; the latter arises from the anterior edge of the orbitar process of the superior maxillary bone, and is inserted into the sclerotic coat between the entrance of the optic nerve, and the insertion of the abductor oculi.

By the superior oblique, the pupil is turned downwards and outwards, and by the inferior, upwards and inwards.

The oblique muscles of the eye form a girth around the eye-ball, between the lens and the bottom of the eye; hence, by their pressure, they increase the distance of the lens from the retina, or increase the posterior part of the axis of the eye-ball.

Sect. VIII.

OF THE NERVES OF THE CONTENTS OF THE ORBIT.

The second or optic nerves have been above described.

The third pair is said to arise from the under and back part of the crura cerebri: they run along the upper part of the cavernous sinuses; pass through the foramina lacera, and give branches to all the muscles of the eyes, excepting the superior oblique and abductor muscles, and send a branch to the ophthalmic ganglion.

The fourth pair arises from the medullary plate which lies over the passage to the fourth ventricle; turn round the crura cerebri, and is spent on the superior oblique muscle of the eye.

The fifth pair of nerves, takes its rise by two distinct parts, from the side of the tuber annulare. Before dividing into its three great branches, the orbitar, superior, and inferior maxillary, there is a ganglion, called the Gasserian, laid across it.

The orbitar branch of the fifth pair passes immediately under the orbitar plate of the frontal bone, and then divides into a larger and smaller branch.

The larger branch sends a nerve along the abductor oculi to the lacrymal gland, and to the membranes and fat near it. Another branch of this nerve joins with a branch of the fifth pair, and forms the Ophthalmic Ganglion, which is placed on the outer side of the optic nerve before the foramen lacerum.

The Ciliary Nerves are derived from the ophthalmic ganglion. The orbitar branch of the fifth pair also detaches the nasal branch, which passes under the levator oculi, to the inner side of the orbit. The continuation of the trunk of this nerve passes through the foramen supra orbitarium, and is distributed on the forehead.

The sixth pair of nerves begins from the tuber annulare; they pass within the cavernous sinus; then through the foramina lacera, and terminate in the abductor muscle of the eye.

SECT. IX.

OF THE APPENDAGES TO THE EYE.

Of the Eye-Lids.

THE eye-lids are convex outwardly; concave inwardly, when they are applied to the eye-balls: nd the upper eye-lid is the larger and more moveable, and covers the greater part of the eye.

When the eye-lids are open, there is always a wrinkle in the skin in each eye-lid, which is most obvious in the upper, in consequence of the eye-lid being drawn under the edge of the orbit.

The eye lids are composed of thin skin, fat, and a portion of the orbicularis muscle, and of the tarsal cartilages situated at the edges of the eye-lids; and are connected to the orbits by condensed cellular substance, which has been improperly called ligament. The eye-lids are united at each end, and are said by anatomists to form the *angles* or *canthi*: The internal is rounded, but the external is acute.

The Tarsal Cartilages are not of an uniform breadth; they are broadest in the centre; and their edges are so shaped, as to form a groove for the tears when the eye-lids are shut.

Of the Ciliary Glands.

The ciliary glands, which are composed of a number of follicles, are placed between the tarsus and lining of the eye-lids.

From these glands, a sebaceous matter is derived, which passes the ducts of these glands, called the *puncta ciliaria*, which are placed upon the edges of the eye-lids.

Of the Cilia or Eye-Lashes.

The cilia or eye-lashes are implanted on the edges of the eye-lids. Those of the upper eye-lid, which are longer than those of the under eye-lid, are bent upwards, and those of the under eye-lid are turned downwards.

These hairs prevent dust or other extraneous bodies from getting into the eye-ball.

Muscles of the Eye-Lids.

NASO-PALPEBRALIS, or *Orbicularis Palpebrarum.*

The fibres of the orbicular muscle are arranged parallel to the edge of the eye-lid; and the fibres of the muscle are concentric.

This muscle, arises by a tendon, from the nasal process of the superior maxillary bone, from the orbitar process of the same bone, and from the internal angular process of the os frontis: its fibres are intermixed with those of the frontal and corrugator and levator labii superioris muscles, and the outer surface of the muscle adheres to the skin of the eye-lids.

The fibres of this muscle decussate each other at the external angle of the eye.

The upper eye-lid is raised by volition; but it is carried down almost involuntarily; for we cannot suspend the motion for a long time.

My Father has concluded, from his experiments, that the orbicularis of the eye-lid, by its pressure on the upper and under part of the cornea, renders it flatter; by which the middle part of the cornea is protruded between the edges of the eye-lids, so as to render the cornea more convex, and at the same time increases the distance of the cornea from the lens, or lengthens the axis of the eye-ball.

ORBITO-PALPEBRALIS, or *Attollens palpebram superiorem.*

The attollens palpebram superiorem is a long thin muscle, placed immediately under the orbitar process of the frontal bone; it arises from the dura mater at the upper margin of the foramen opticum, and forms a broad tendinous expansion, which is fixed to the superior margin of the tarsus.

SECT. X.

OF THE SUPERCILIA OR EYE-BROWS.

THE eye-brows are arched eminences, covered by hair, which extend from the root of the nose to the temples.

The eye-brow consists of a thick doubling of skin, covered by hair and fat, of the orbicularis,

frontal and corrugator supercilii muscles, and of bloodvessels and nerves.

The hairs of the supercilia are disposed downwards and outwards, in order to prevent the sweat from getting into the eye-ball.

The eye-brows are raised by the occipito-frontalis, corrugator supercilii, and somewhat depressed by the orbicularis palbebrarum muscles.

The eye-brows assist very materially in expressing the various passions of the mind.

FRONTO-SUPERCILIARIS, or *Corrugator Supercilii.*

This muscle arises from the internal angular process of the os frontis, and is fixed behind the occipito-frontalis muscle, into the middle of the superciliary ridge.

By this muscle, the eye-brow is drawn downwards and inwards, by which the skin between the muscles of opposite sides is thrown into longitudinal folds.

SECT. XI.

OF THE ORGAN BY WHICH THE TEARS ARE SECRETED, AND OF THE PASSAGES BY WHICH THE TEARS ARE CONVEYED TO THE EYE-BALL, AND FROM IT INTO THE NOSE.

Of the Lacrymal Gland.

THE lacrymal gland is of a yellow colour, consisting of numerous lobules, united by cellular

membrane, situated above the junction of the upper and under eye-lids at the outer and upper part of the orbit, and behind the outer end of the superciliary ridge.

There is a small ligament, which has been described by SOEMMERING, which passes from the external and posterior part of the lacrymal fossa under the gland; by which this gland is retained in its place.

The lacrymal gland is supplied by the ophthalmic artery. The nerves of this gland are derived from the ophthalmic nerve.

There is also a cluster of smaller lacrymal glands, situated between the larger lacrymal gland, and the upper eye-lid.

Of the Lacrymal Ducts.

My Father discovered the lacrymal ducts, which in the human body are small; they pass out from the anterior part of the gland, and do not communicate with each other.

There are usually only five or six ducts to be seen, which terminate on the inner side of the upper eye-lid, near to the outer angle of the eye *.

The tears pass across the eye, and are diffused by the motion of the eye-ball, and are absorbed by the puncta lacrymalia.

* Vide Plate 5. of my Father's Treatise on the Eye and Lacrymal passages, in which the ducts of the lacrymal gland are represented, and bristles are introduced into them.

Of the Puncta Lacrymalia *.

There are two puncta lacrymalia, a superior and inferior, through which the tears pass into the lacrymal sac.

Each punctum is surrounded by a cartilaginous border, by which it is kept always open.

The superior punctum is placed near to the inner angle of the eye, of the upper eye-lid; it ascends for about one-eighth of an inch, and then turns inwards at a right angle; then ascends obliquely. The inferior punctum passes downwards; describes an acute angle, and then passes obliquely upwards.

The puncta approach each other; they are separated by the caruncle, and sometimes form a common duct behind the tendon of the orbicularis muscle; but in most cases the puncta open into the lacrymal sac separately †.

The tears are absorbed by the puncta, in consequence of capillary attraction, and conveyed through the ducts into the lacrymal sac.

* Vide Plate 6. of my Father's Treatise on the Eye and Lacrymal Ducts.

† Vide a description of these ducts in Dr Monro *senior's* Obs. Anat. & Phys. published 1758.

Of the Lacrymal Sac.

The lacrymal sac is lodged in a groove formed by the os unguis and os maxillare *.

This sac is of an irregular form, and somewhat approaches to an oval; the lower end of it is somewhat contracted, which is connected with the nasal duct.

This sac is composed of a tough white mucous membrane, of great vascularity, and is covered by the tendon of the orbicularis muscle, excepting at its upper rounded part, and by a layer of condensed cellular substance.

The nasal duct which communicates with the lacrymal sac, is inclosed in a bony canal, formed by the superior maxillary bone and os unguis. The duct runs obliquely backwards and downwards, and terminates at the lower end of the inferior turbinated bone, by a round aperture †, in SNEIDER's membrane.

The nasal branch of the fifth pair of nerves, after supplying the anterior part of the nostrils, and

* Vide Plate 6. fig. 1. of my Father's Treatise on the Eye and Lacrymal Ducts.

† Vid. Plate 6. fig. 1. of my Father's Treatise on the Eye and Lacrymal passages.

the fore-part of the septum narium, passes to the inner corner of the eye, and is distributed upon the lacrymal sac.

Of the Ductus Incisivus, or Passage from the Nose into the Mouth.

This duct opens behind the incisor teeth of the upper jaw, into the mouth; and hence has been called *ductus incisivus* *. The groove for this duct is more or less distinct in different skulls; sometimes it is very manifest, but on other occasions superficial; and my Father observes, that " in by far the greater number of human subjects, of different ages, I have not been able to find any vestige of such ducts, in the bottom of the nose, or roof of the mouth: But, in a few subjects, I have found them, open at both ends, but always very much smaller than in the quadruped. In some of these, I passed a bristle or small probe, very readily, from the nose into the mouth. In two or three subjects, I first poured quicksilver from the nose, through the ductus incisivus, into the mouth; and then, with a small syringe, injected through it melted wax, coloured with vermilion: And these preparations, which I have preserved and demonstrated for a great number of years, are accurately delineated in Table vi. fig. 4, 5, 6, 7."

* Vid. Plate 6. fig. 4. appended to my Father's Treatise on the Eye.

Of the Caruncula Lacrymalis.

The caruncula lacrymalis, is a small conglomerate gland, of a red colour, which was supposed to secrete a share of the tears: it is situated between the inner angle of the eye-lids, and secretes a sebaceous matter.

From the caruncula, one or two hairs grow.

There is a small vascular fold of the tunica adnata, named *palpebra tertia,* which is placed between the caruncula lacrymalis and the ball of the eye.

Of the Chemical Analysis of the Tears.

The tears, which are transparent and colourless, with scarcely any smell, but a saline taste, are composed of the following ingredients:

Water.
Mucus.
Muriate of soda.
Soda.
Phosphate of lime.
Phosphate of soda.

The saline parts amount only to about 0.01 of the whole. The specific gravity of the fluid, is somewhat greater than that of distilled water *.

* THOMSON's Chemistry, vol. v. p. 595.

Explanation of Plate 41.

Fig. 1. represents the human eye dissected.

a The optic nerve.

b b The sclerotic coat, cut and turned outwards.

c The sclerotic coat, cut and turned forwards with the cornea *d*.

e e One-half of the iris in its place.

f The pupil and crystalline lens in its place.

g g The ciliary circle.

H H The choroid coat.

h The ciliary processes seen in their places, by cutting off a portion of the iris.

i A portion of the iris cut and turned back.

k The floating points of the ciliary processes turned backwards.

l The middle smooth part of the retina, seen by cutting a hole in the choroid coat.

m The roots of the ciliary processes of the retina, to which the black paint of the ciliary processes of the choroid coat adheres.

n The ciliary processes of the retina, inserted into the capsule of the crystalline lens.

Fig. 2. represents, chiefly, the circle of PETIT in the human eye.

a a The vitreous humour inclosed in its capsule.

b The crystalline lens inclosed in its capsule.

c The ciliary processes of the retina inserted into the capsule of the crystalline lens.

d The circular canal of PETIT inflated.

e A hole cut in the circular canal of PETIT, at which the air distending it was blown in.

CHAPTER V.

OF THE ANATOMY OF THE EAR.

The Organ of Hearing.

THE ear in different animals, is of a more or less complicated structure.

In the lower classes, it consists merely of a membranous bag, upon which the branches of the nerves are distributed; but in the higher orders, a number of accessory parts are superadded.

In describing the human ear, it has been customary with anatomists to divide it into External and Internal parts; by the former, is meant the external cartilage of the ear, and the meatus auditorius externus: and by the latter, those parts which are internal with respect to the membrane of the drum.

SECT. I.

OF THE EXTERNAL CARTILAGE OF THE EAR.

THE external cartilage of the ear, which varies in shape in different individuals, is attached by

means of the skin, ligaments, and muscles, to the temporal bone.

Different parts of it are distinguished by different names.

The cartilaginous part has been called the *ala*, or *wing*, to distinguish it from the soft pendent part underneath, called the *lobe*.

The outer border of the cartilage, has been called the *helix*; and the semicircular part within it, the *antihelix*.

The moveable cartilage which shuts the external passage, is named the *tragus;* and an eminence at the extremity of the antihelix, opposite to this, the *antitragus*.

There is a small cavity between the helix and antihelix, called *innominata*; and another cavity somewhat like a boat between the limbs of the antihelix, called *fossa navicularis*.

There are certain muscles fixed in this cartilage of the ear for elevating it, drawing it forwards, and drawing it backwards; but few persons are capable of throwing these muscles into action. There are a few thin muscular fibres implanted upon the cartilage of the ear, which are calculated for stretching it; but I believe I may say, that few, or perhaps none, can throw these muscles into action.

Certain names have been appropriated by anatomical authors to these muscles, descriptive of their situations on the external cartilage of the ear.

The muscles which move the whole external cartilage of the ear, are the following:

TEMPORO-AURICULARIS, or *Attollens Aurem.*

This muscle arises by a curved line from the tendinous aponeurosis of the temporal muscle, and is fixed by a broad tendon to the eminence on the inner side of the antihelix.

By this muscle, some persons can raise the external cartilage of the ear.

ZYGOMATO-AURICULARIS, or *Anterior Auris.*

This arises from that part of the aponeurosis of the temporal muscle, which covers the middle of the zygoma; it passes backwards and downwards, and is fixed into the inner side of the helix.

By this muscle, the helix is drawn forwards.

MASTOIDO-AURICULARES, or *Retrahentes Aurem.*

This muscle consists of three parts, which arise from the posterior part of the root of the mastoid process, and are fixed into the projection which corresponds with the hollow of the concha.

These muscles tend to stretch the concha. By the above muscles, the cartilage of the ear is drawn

upwards, forwards or backwards; and by their combined actions, in the intermediate directions.

There are five small muscles on the external cartilage of the ear.

The *Tragicus*, which arises from the middle and outer part of the concha, at the root of the tragus, and is inserted into the point of the tragus.

This muscle is said to pull the *tragus a little forwards.*

The *Antitragicus* arises from the internal part of the antitragus; upon which it turns forwards, and is inserted into the tip of the antitragus.

By this muscle, the tip of the antitragus is turned outwards, and the extremity of the antihelix is depressed.

The *Transversus Auris* arises from the prominent part of the concha, on the dorsum or back-part of the ear, and is said to stretch the scapha.

Two muscles have been described under the names, *Helix major* and *minor*: the former arises from the anterior part of the helix, and is fixed into the helix; and the latter from the under and fore part of the helix, and is fixed into the helix.

The *Concha* is a large cavity under the antihelix, which is divided by the helix into two parts; the inferior of which leads to the meatus auditorius externus.

These muscles are so insignificant, as to have little or no power in pulling the helix downwards.

By means of the external cartilages of the ear, the pulses of sound are reflected into the external passage; the intensity of which, is increased during their progress through the meatus auditorius externus.

The external meatus is not straight; it turns forwards and inwards, and ends in the membrana tympani.

The cuticle with which this passage is lined, is perforated by the orifices of a number of small glands, which secrete the wax of the ear, which serves to defend the membrane of the drum from the air; and being very bitter, may have an effect, along with the hairs in that passage, in preventing insects from entering.

The external passage is closed up by the membrana tympani, which has lately been described as a muscle with radiated fibres.

The membrana tympani, is in shape oval, about $\frac{8}{20}$ of an inch long, and $\frac{7}{20}$ broad.

The membrana tympani is placed obliquely in a groove of bone, and the upper part of it is turned outwards, and the under inwards.

The branches of the temporal and occipital arteries supply the external ear with blood.

The nerves of the external ear are derived from the third branch of the fifth pair of nerves, and from the portio dura of the seventh pair.

Sect. II.

OF THE INTERNAL PARTS OF THE EAR.

The internal ear consists of two cavities and their appendages.

The *Tympanum*, which is filled by air, is of an irregular figure, and about half an ineh in breadth. This cavity is separated from the *Labyrinth* by a plate of bone, in which there is a projection, which divides the tympanum into an Anterior and Posterior part. There is also within the tympanum a projection formed by the aqueduct of Fallopius.

There are two other eminences, one at the upper and fore part of the tympanum, for lodging the muscle called *Tensor Tympani;* and another behind the oval-shaped hole for the passage of the muscle called *Stapedius.*

The tympanum communicates with the posterior fauces by the *Aristotelian* or *Eustachian tube,* which begins at the upper and fore part of the tympanum; and runs forwards and inwards. This tube is like a trumpet in form, being narrow next the ear, and bony; but much wider next the throat, and composed of cartilage.

This tube is lined by a vascular membrane.

The tympanum also communicates at its upper and back part with the cells of the mastoid pro-

cess of the temporal bone, which are irregular in figure and size. Sometimes the cells are small and numerous, but at other times there are only two or three large cells, which communicate with each other.

In quadrupeds, there are large cells or cavities communicating with the tympanum, and supplying the place of mastoid cells.

The tympanum of the skeleton communicates with the *Vestible* by an oval-shaped aperture, which in the recent body is filled up by membrane, and lodges the base of one of the chain of bones which passes across the tympanum.

The tympanum also communicates with a half of the turns of that part of the ear, called *Cochlea*, by a round aperture, which is placed obliquely backwards and outwards, and which in the recent body is shut up by a membrane.

Of the Chain of Bones.

There are four bones stretched across the tympanum; the MALLEUS, INCUS, OS ORBICULARE, and STAPES, which are covered by the periosteum, and articulated to each other by capsular ligaments.

The *Malleus* or *Hammer*, consists of a round head, a small neck and handle, and two little processes.

The head of the bone is turned upwards and inwards, and forms an angle with the neck of the bone, and is laid along the membrana tympani, to which it adheres.

The *Incus* or *Anvil*, consists of a body, and two crura, of equal length.

The shorter crus extends backwards, and is joined by ligament to the edge of the mastoid opening.

The *Os orbiculare* is articulated with the long process of the incus.

The *Stapes*, so named from being like a stirrup, is placed horizontally, and is divided into a head, crura, and base.

The base of the bone is of an oval shape, and its edges correspond with those of the fenestra ovalis. The longest crus of the stapes is placed backwards.

There are three muscles by which the chain of bones is moved.

The Laxator Tympani.

This muscle arises, by a small beginning, from the extremity of the spinous process of the sphenoid bone, behind the entry of the artery of the dura mater; after which it runs backwards, and a little upwards, along with the nerve, called *chorda tympani*, in a fissure of the os temporis near

the fossa that lodges the condyle of the lower jaw.

This muscle is fixed into the long process of the malleus within the tympanum, where it rests upon the edge of the fissure between the pars squamosa and petrosa.

This muscle tends to draw the malleus obliquely forwards towards its origin; consequently, the membrana tympani, is made less concave, or is relaxed.

Tensor Tympani.

This muscle arises, by a very small beginning, from he cartilaginous extremity of the Eustachian tube, just where it begins to be covered by the pars petrosa and spinous process of the sphenoid bone, near the entry of the artery of the dura mater: from thence running backwards near the osseous part of the Eustachian tube, it forms a very distinct fleshy belly, below a thin osseous plate, between the pars squamosa and labyrinth; and sends off a slender tendon, which makes a turn into the tympanum, along with the nerve called *chorda tympani.*

This muscle is fixed into the posterior part of the handle of the malleus, a little lower than the root of its long process.

By this muscle, the malleus and membrana tympani are pulled inwards towards the pars petrosa,

by which the membrane of the drum is made more concave and tense.

Stapedius.

This muscle arises by a small fleshy belly, from a little cavern in the pars petrosa, near the cells of the mastoid process, before the inferior part of the passage for the portio dura; its tendon passes through a small round hole in the side of the same cavern; enters the interior part of the tympanum, and is inserted into the posterior part of the head of the stapes.

By this muscle, the stapes is drawn obliquely upwards, by which the posterior part of its base is moved inwards, and the anterior part outwards.

The air within the tympanum increases the force of the sound; to which the tension of the membrane of the drum and of the chain of small bones essentially contributes; and the vibrations of sound are thus communicated from the membrane of the drum to the membranes of the round and oval apertures, and the tension of the chain of bones is probably adapted to the kind of sound. The parts which communicate with the tympanum increase the intensity of the sound.

Of the Labyrinth or Vestible.

The Labyrinth, placed at the inner part of the tympanum, is of an irregular form; much smaller than the tympanum, and contains a sac which is filled by a gelatinous fluid.

A part of the gelatinous fluid of the labyrinth is supposed by COTUNNIUS to be absorbed by two small conical-shaped canals; one of which he has described as taking its rise at the under-part of the scala tympani, and as terminating on the surface of the dura mater; the other canal, he observes, descends from the vestible, and terminates between the layers of the dura mater.

The arteries of the vestible are derived from the vertebral arteries, which pass through the foramina at the bottom of the meatus auditorius internus.

There are several parts which communicate with the labyrinth.

The *three semicircular canals* communicate with the vestible by five apertures; for two of the canals have a common termination. The *cochlea* also communicates with the vestible, and, in the skeleton, the *tympanum*.

The canals, called improperly *semicircular*, as they describe a greater portion of a circle, are three

in number; the Superior, the Posterior, and Exterior.

These osseous canals are not of an uniform size, being enlarged at one end, into what has been called by anatomists *ampulla*; and they include within them cartilaginous canals.

Of the Cochlea.

The *cochlea*, so named from its resemblance to a turbinated shell of the snail kind, is composed of two complete turns and a half; and a central pillar, called *modiolus*, which is continued to the middle of the second turn.

These turns are separated from each other by a partition, called *lamina spiralis*, into two windings, called its *scalæ*; the one communicates with the tympanum by the foramen rotundum, and is hence called *scala tympani*; the other communicates with the vestible, aud therefore has been called *scala vestibuli*.

These scalæ are of a conical figure; they are narrowest at the apex of the cochlea, where they communicate with each other by a common tube, called *infundibulum*; one end of which begins at the termination of the modiolus, and the other end is fixed to the osseous top or cupola of the cochlea.

My Father has investigated with much care the structure of the cochlea, and his account of it I have subjoined:

"The central pillar of the cochlea consists of two parts, called *modiolus* and *infundibulum*.

"The modiolus is not a solid osseous cone, as has been generally supposed, but may be considered as a hollow cone, containing that branch of the portio mollis which is destined for the cochlea; and is everywhere cribriform, for the passage of the branches of that nerve. The infundibulum is an imperfect osseous funnel, connected to the top of the modiolus. So that the modiolus and infundibulum are two hollow conical bodies, connected together by their small ends. The plate which is between them, and in the centre of both, is cribriform. Around the modiolus, the first gyrus of the cochlea, and half of the second gyrus are described; the other half gyrus incloses the root of the infundibulum; and the upper ends of the gyri, which communicate with each other, are covered or inclosed by the cupola of the cochlea.

"The partitions of bone which separate the gyri from each other, are not composed of one solid plate, as authors have represented *, but consist of two plates, connected to the modiolus at some distance from each other.

"The osseous root of the lamina spiralis is likewise composed of two plates, connected to the

* Du Verney.—Cassebohm, T. 5. F. 7, 8, 9, 10.—Scarpa, P. 10. F. 3. 7.

modiolus or root of the infundibulum, at some distance frem each other.

"I have already observed, that the modiolus is composed of a cribriform hollow cone, the sides of which consist of two thin plates; and the holes in it are much more numerous than they have been described to be by authors, and are not disposed in the regular manner they have represented them *.

"They are to be seen in every part of the surface of the modiolus; but are most numerous close to the roots of the osseous septa, which separate the gyri from each other; and close to the outer sides of the root of the lamina spiralis. They are numerous in the plate between the modiolus and infundibulum; and when the osseous septa and lamina spiralis are cut near the modiolus, they are seen in the side of the modiolus, between the two plates which compose the septa and lamina spiralis."

Of the Nerves of the Ear.

The ear receives its nerves from the seventh pair.

The seventh pair enters the ear by the meatus auditorius internus, the bottom of which is cribriform, and separated by a ridge into an inferior

* CASSEBOHM, T. 5. F. 10.

and superior fossula. The nerves which go to the vestible and semicircular canals, pass through the inferior fossula; and those which go to the vestible, through the superior.

My Father has also described in the following words, with great care, the minuter ramifications of the branches of the portio mollis, distributed upon the semicircular canals, cochlea, and vestible:

" I found, that the portio mollis is composed of two branches nearly equal in size; one of which supplies the vestible and semicircular canals, and the other the cochlea:

" That each branch consists of a great number of small chords:

" That the small chords of both branches pass through different minute holes into the vestible and cochlea, or, that the bottom of the canal in the back-part of the os petrosum, commonly called *meatus auditorius internus*, is cribriform.

" As the osseous partitions which divide the cochlea into its gyri, as well as the lamina spiralis, which divides the gyri into scalæ, are connected to the circumference of the modiolus; we might expect to find the branches of the portio mollis conducted, from the modiolus, to the membranes lining the cochlea, by means of these partitions, or between or along the outer sides of the two osseous plates which compose them, as well as between the two lamellæ which compose the lamina spiralis, or along the outer sides of these; as we

would suppose, that the two sides of each scala should have nerves distributed on them in the same manner.

"Accordingly, on prosecuting the branches or fibres of the portio mollis with the utmost attention, I find, that they pass outwards from the cavity of the modiolus, through innumerable minute holes or canals, which every where perforate it. Some fibrils pass between the two plates which form the septa that separate the gyri from each other. A still greater number of fibrils passes through holes between the two plates which compose the root of the lamina spiralis. But by far the greatest number of the nervous fibrils perforates the sides of the modiolus, between the osseous septa and the lamina spiralis. The fibrils which pass through the holes that are nearest to the lamina spiralis, run to the membrane covering the lamina spiralis; whilst those which are nearest to the septa, run in a contrary direction, to the membranes covering the septa. We perceive, therefore, that the part of the membrane lining each scala, which is the most distant from the modiolus, will be supplied by the terminations of of these two sets of fibrils meeting. The nervous fibrils on the surface of the lamina spiralis, seem larger, and are more regularly disposed, than those that run on the surface of the septa. Two plates are found in the outer osseous part of the lamina spiralis, and the space between them is filled with nervous fibres, from which numerous

minute fibrils issue between the outer edges of the two plates. There are likewise minute holes in the sides of each of the plates which compose the lamina spiralis; and there can be no doubt that the nerves between the plates are connected with those which run on their external surface.

"The last branches or fibres of the portio mollis pass through the cribriform plate, in the top of the modiolus, which is common to it and the infundibulum, to supply the last half-gyrus and cupola of the cochlea.

"I next observed, that the several branches of the portio mollis, in their whole course along the lamina spiralis, formed an elegant and intricate plexus, by innumerable joinings and separations of their component fibrils.

"At the root or osseous part of the lamina spiralis, the nerves are white and opaque; but at the flexible and membranous parts, they are semipellucid.

"This change of colour is like to that we observe the optic nerve undergoes on entering the eye-ball to form the retina: and, in both, the change of colour is not very gradually made, but suddenly.

"On comparing the semipellucid outer part of the lamina spiralis with the retina of the eye, I observed a remarkable difference; to-wit, that in the retina the texture seems pulpy and uniform,

without any such appearance of fibres and net-work, as we might expect to observe from the name *retina*, which has been so long and universally given to it; whereas, in the ear, fibres and the continuation of an intricate net-work can be seen distinctly in the semipellucid part of the lamina spiralis, and as far as to its outer edge.

"I have, therefore, in my Lectures, long observed, that the term *retina* was improper when applied to the nerve spread out on the bottom of the eye, and had been given, not in consequence of accurate observation of the structure, but from a common favourite theory of anatomists, which supposes that the brain and nerves consist of fibres. In the ear, the term may be, with great propriety, applied to describe the appearance of the branches of the portio mollis, in their course on the lamina spiralis.

"At the outer part of the lamina spiralis, the nervous fibres and net-work become much less evident; and, upon the continuation of these membranes, on the inner sides of the gyri of the cochlea, the nerves seem to terminate in a semipellucid pulpy substance, very like to the retina of the eye."

Sound, according to the experiments of my Father, is as rapidly communicated through water, as through air; and thus the branches of the portio mollis distributed upon the cochlea and semicircular canals, are affected by the tremulous move-

ments of the membranes of the round and oval holes.

The pulpy membrane of the vestible and cochlea, on which the branches of the portio mollis are distributed, is the most essential part of the organ of hearing, and upon which the sense depends; all the other parts of this complex organ, are but of secondary importance.

There is another nerve proper to the ear, the course of which, is very remarkable, called *portio dura*, which goes through the canal of Fallopius; from which a reflected branch is derived, which passes through the foramen innominatum in the pars petrosa, and is connected with the portio dura, and second part of the fifth pair of nerves: another branch, called *chorda tympani*, runs across the tympanum, between the inferior crus of the incus and the handle of malleus, at the outside of the Eustachian tube, to join the lingual of the fifth pair; and in its passage distributes branches to the muscles of the malleus and membranes of the tympanum.

Explanation of Plate XLII.

The two figures of this Table represent the distribution of the branches of the portio mollis within the two scalæ of the cochlea, or the nervous webs or retinæ these form.

Fig. 1. represents the distribution of the branches of the portio mollis, on one side of the lamina spiralis.

a The large branches of the portio mollis, at the root or osseous part of the lamina spiralis.

b The continuation of these branches on the soft part of the lamina spiralis.

c The outer part of the lamina spiralis, separated from the bone of the cochlea.

These nerves, in their whole course, form an intricate and beautiful plexus, by repeatedly joining into trunks, and these separating into branches.

Fig. 2.

M Represents the modiolus.

a The plexus of nerves on the osseous part of the lamina spiralis.

b The plexus of nerves on the outer and softer part of the lamina spiralis.

c The outer part of the lamina spiralis, dividing into its two constituent layers or membranes, one of which *d*, continued, lines the scala of the vestible, and the other layer *e*, continued, lines the scala of the tympanum.

CHAPTER VI.

OF THE ORGAN OF TASTE.

THE Tongue is the seat of the sense of taste; and is proportionally broader in man than in quadrupeds.

The structure of the human tongue has been explained in a preceding volume.

I therefore shall only observe, that the papillæ which cover its surface, render it a still more perfect organ of taste, to which the thinness of the cuticle, which covers the surface of the tongue, essentially contributes.

The tongue, like the other organs of sense, is very largely supplied by bloodvessels and nerves.

The tongue is supplied with blood by the arteria ranina, a branch of the internal carotid.

The tongue receives its nerves from three different sources; from the 5th, 8th, and 9th pairs of nerves.

The upper part, and also the point of the tongue, is supplied by a branch of the inferior maxillary branch of the fifth pair of nerves.

The eighth pair of nerves arises from the sides of the corpora olivaria of the medulla oblongata, and consist on each side of the pars vaga and glosso-pharyngeus. Both these nerves pass out through the hole in the base of the skull, common to the temporal and occipital bones.

A branch from the glosso-pharyngeus joins with the digastric branch of the portio dura.

The glosso-pharyngeus gives off branches, which, uniting with the pharyngeal branch of the eighth pair and sympathetic nerve, form the plexus which covers the internal carotid artery, from which branches go to the heart. The glosso-pharyngeus supplies the tonsil, the upper part of the pharynx, the epiglottis, and then divides into branches, which are distributed upon the middle of the root of the tongue.

The ninth pair of nerves arises from the under and lateral parts of the corpora pyramidalia; and pass through the superior condyloid holes. The nerves of opposite sides are then conjoined by a cross branch with the sub-occipital nerve. The nerve then descends between the internal carotid artery and internal jugular vein; crosses the carotid arteries, and sends a branch down along the common carotid, called *descendens noni*. The trunk of the nerve afterwards passes behind the facial and temporal veins; and upon the hyoglossus muscle, this nerve divides into many branches, which supply the middle of the tongue, and joins with the ramifications of the lingual branch of the fifth pair.

The bloodvessels and nerves of the tongue, have a very great effect upon each other; in proof of which, my Father observed in many of his experiments, that throwing a ligature around the great bloodvessel leading to this member of an animal, had the effect of diminishing the nervous energy of that part of the body; and, on the other hand, NUCK has informed us, that when he divided the nerves leading to the salivary glands, the quantity of saliva secreted by the arteries, was sensibly diminished.

The papillæ of the tongue are probably erected when a sapid body is applied to them; and it seems also probable, that the flavour of some substances is more distinctly perceived by one set of the papillæ, than by another; for some substances make a deeper impression on the point, others on the middle, and a third set on the back-part of the tongue.

There is much variety as to the perfection of this sense in different individuals, and also many peculiarities as to taste, which are in some instances the effect of custom, of caprice, of pregnancy, or of disease.

CHAPTER VII.

OF THE ORGANS OF TOUCH.

SECT. I.

OF THE SKIN.

THE Skin, the common integument, is thicker on the outer than the inner part of the extremities of the body, and much thinner where flexion is required, or where it covers the more sensible parts of the body: it is also elastic.

The skin consists of three, and according to BAYNHAM, of four distinct membranes, viz. of the Epidermis or Cuticle, the Corpus or Rete Mucosum, of the True Skin, and of BAYNHAM's membrane.

Of the Cuticle.

The *Cuticle* is a transparent, insensible, laminated membrane, disposed in lines in many parts of the body, not uniformly thick, and perforated by the orifices of exhalent vessels, excretory ducts, and absorbent vessels, and by hairs: and the vessels of it are so small as not to admit the red blood.

The cuticle is connected to the subjacent membrane, by a number of small cellular threads, bloodvessels, and nerves.

The cuticle covers every part of the true skin, except under the nails; and it is also reflected inwards, and lines all the apertures, the nose, eyes, mouth, ears, pharynx, gullet, anus, urethra, vagina; and it also forms sheaths for the hairs.

The cuticle is less prone to putrefaction than other parts of the body, and may be taken off, in the form of a glove, from the hand of a putrid body.

There are various furrows in different parts of the cuticle, which form figures with different angles on the back of the hand, and spiral lines on the toes.

Chemical Analysis of the Cuticle.

It appears from the experiments of Mr HATCHETT, that the cuticle, in all its properties, resemble coagulated albumen.

Of the Nails.

The nails make a part of the cuticle; they consist of fibres disposed in laminæ, are transparent, insensible, excepting where they adhere to the skin; and as the longest fibres of nails are outermost, therefore the nails are thinner at their edges.

The nails are fixed at their roots by a semilunar fold of the skin, and are covered by a reflection of the cuticle.

The nails grow from the roots.

The nails assist us in picking up very small bodies, and are also well calculated for defending the extremities of the fingers and toes.

Of the Corpus Mucosum, or Rete Mucosum.

The corpus mucosum, which is situated under the cuticle, gives colour to the skin.

The corpus mucosum covers every part of the true skin, excepting under the nails, and connects it to the cuticle.

The colour of this substance is seen through the semitransparent cuticle.

The corpus mucosum is a viscid substance, which envelops a great many small bloodvessels and nerves, which pass to the cuticle.

The corpus mucosum is not of an uniform thickness; hence the palms of the hands and soles of the Negro, are not of so dark a colour as the rest of his body; and even in individuals of the same nation, it is darker in some parts of the body than in others, as in the arm-pits and eye-lids.

It differs not only in colour, but in thickness, in different nations; being not only of a darker colour, but much thicker and stronger in the Negro than the European: and, in the former, may be divided into layers.

The corpus mucosum is slowly regenerated; hence a long time elapses, before a part which has been blistered, regains its original colour.

The corpus mucosum is probably secreted by the vessels of the true skin, as the pigmentum nigrum is secreted by the vessels of the choroid coat of the eye.

The dark colour of the Negro has been imputed to the influence of the sun; as men are of a fair complexion in temperate climates, and swarthy in tropical climates.

The above theory is objectionable, as all the inhabitants of tropical climates are not of the same complexion.

It is extremely difficult to determine on what the colour of the corpus mucosum depends.

Baynham's Membrane.

Mr BAYNHAM has described a very fine membrane, which, he observes, covers the true skin, but it is seen only when the vessels of the skin of those who have died from the small-pox, have been filled successfully.

Of the Cutis Vera, or True Skin.

The *Cutis vera* is a strong elastic fibrous membrane, which is largely supplied by bloodvessels and nerves.

The fibres of the cutis vera are very intimately interwoven with each other, like those in the felt of a hat, and cross each other in every direction, so that it is impossible to trace their course.

The skin of the extremities of the fingers and toes, is disposed in ridges.

There are a number of papillæ or small processes, on the surface of the cutis vera, and which are most numerous in the more sensible parts of the body, as upon the lips, the penis, and at the points of the fingers and toes, where they are placed in double rows upon the ridges.

These papillæ have commonly been supposed to be formed by the terminations of the nerves of the skin, and of a plexus of small bloodvessels.

In the skin of the belly and thighs of women who have had children, there is a growth of an imperfect new skin, between the parts of the true skin.

In the human body, there is no muscle which extends over the whole body like the thin muscle which corrugates the skin of the horse or the dog. The only muscles in the human body which bear an analogy to it, are the *occipito-frontalis* and *platysma myoides*.

Chemical Analysis of the Cutis Vera.

The cutis vera, according to Dr Thomson, is a peculiar modification of gelatine; and is "enabled to resist the action of water partly by the compactness of its texture, and partly by the viscidity of the gelatine of which it is formed *."

Sect. II.

OF THE PHYSIOLOGY OF THE SKIN.

The skin is subservient to three different purposes: it is the seat of the *sense of touch;* it is an *organ of absorption;* and *of secretion.*

Every part f the surface of the body, may be said to be the seat of the sense of touch.

Every part of the skin does not possess the same degree of sensibility; the cuticle being much thicker, and the nerves being more numerous, in some than in other places.

By this sense we are less apt to be deceived than by the other senses, there being no intermediate body between the substance and us, when that substance affects the nerves of touch.

* Chemistry, vol. v. p. 530. 4th edit.

Dr Reid has justly observed: "We perceive not one quality only, but many, and these of different kinds. The chief of these are heat and cold, hardness and softness, roughness and smoothness, figure, solidity, motion, and extension; whereas the senses of smelling, of tasting and hearing, are very simple and uniform; each of them exhibiting one kind of sensation, and thereby indicating only one of the qualities of the bodies."

There are some animals, as the *bat*, which are so constructed as to receive such delicate impressions of resistance, motion and temperature, that Spallanzani has been led to suppose that they possess *a sixth sense*. He observed, that these animals when set at liberty, after he had put out their eyes, and had stopped their ears and noses, were capable of flying through subterraneous crooked passages without striking against the walls, and even avoided many obstacles which were put in their way.

The skin is also an *organ of absorption*. There are some anatomists who have described the manner in which the absorbent vessels of the skin take their rise from that organ. But I believe that the absorbent vessels of the surface of the human skin cannot be demonstrated, though there cannot be a doubt that the skin is an organ of absorption; for mercury, turpentine, and various other substances rubbed upon the skin, are rapidly taken into the general system.

The orifices of the absorbent vessels of the skin of fishes may be demonstrated, as my Father discovered in the skate. The absorbent vessels of that fish are not provided with valves; and hence any fluid thrown into their larger trunks passes readily into the smaller branches, and flows out by a number of orifices, which are regularly disposed upon the surface of the skin *.

The skin is an *organ of secretion.* There are a number of vessels which open upon the surface of the skin, through which the matter of insensible perspiration passes. The perspirable matter may be perceived, by confining the arm in a clear glass vessel.

The quantity of matter discharged by the insensible perspiration, is, according to the experiments of SANCTORIUS, KEIL, RYE, ROBERTSON, SEGUIN, and others, greater than all the other excretions.

The quantity of the insensible perspiration varies in different climates; the warmer and drier the climate, *cæteris paribus,* the greater the quantity of the perspiration.

The matter contains water; according to CRUICKSHANK, an oil; and according to BERTHOLLET, the phosphoric acid.

There are also the ducts of a number of glands, which are placed under the skin, and open upon its surface; these secrete a concrete ceruminous matter, which may be squeezed out from the

* *Vid.* MONRO on Fishes.

orifices of the ducts of these glands in the form of small worms.

This substance is sometimes accumulated in the form of small white fetid lumps between the glans of the penis and the prepuce.

These sebaceous glands are most numerous in such parts of the skin as are exposed to the air, or to attrition; as in the nose, ears, nipples, and external parts of generation.

There are some authors who have described what they have called *miliary glands*, which they have supposed serve for the secretion of the matter of perspiration.

Anatomists are not agreed whether the sensible perspiration or sweat, and the insensible perspiration, pass through the same or a different system of vessels.

According to SPALLANZANI, the skin produces the same changes upon the air as the lungs.

Air has also been stated to be secreted by the skin.

SECT. III.

OF THE HAIRS.

EVERY part of the human body is covered with hairs, which vary as to length and fineness in different parts of the body; those of the head and beard are the longest; and then those of the pubes and axillæ, nostrils, ears, eye-lashes, and eye-brows.

The hairs grow from bulbs of various forms, which are imbedded within the cellular substance under the skin.

Each bulb has been said to have two capsules or membranes, with an oily fluid interposed between them, from which the hairs derive their colour.

Different opinions have been entertained respecting the structure of the human hairs. According to some authors, each hair is made up of a series of smaller hairs; and according to others, each hair is a tube through which the oily fluid which gives the hair a peculiar colour, flows.

It must be acknowledged, that we are still ignorant respecting the structure of the human hairs, which are so slender as to render it extremely difficult to examine their structure.

In quadrupeds, the hairs are much larger; and the bristles of the boar, when examined by the aid of the microscope, have been observed to be composed of a number of filaments; and in the middle of the bristle, there are two canals, which contain a liquor, called the *medulla*.

Chemical Analysis of Hair.

From the experiments of VAUQUELIN, it appears, that black hair is composed of the following ingredients:

An animal matter, constituting the greatest part.

A white solid oil, small in quantity.
A greyish-green oil, more abundant.
Iron, state unknown.
Oxide of manganese.
Phosphate of lime.
Carbonate of lime, very little.
Silica.
Sulphur.

The colouring matter of hair, according to the same distinguished chemist, is an oil, which is blackish-green in black hair; red, in red hair; and white, in white hair. He also supposes that sulphureted iron contributes to the colour of dark hair.

SECT. IV.

OF THE FAT.

FAT is lodged in the cellular substance, in small vesicles, which are surrounded by a network of bloodvessels.

Fat is found, not only under the skin, but also between the muscles; in the cheeks, orbits, on the surface of the heart, around the kidneys at the loins, in the omentum, &c.

But there is no fat within the brain, in the eyelids, within the lungs, liver, spleen, or kidney.

Of the Uses of the Fat.

The fat serves a variety of purposes. By filling up the interstices, it gives the members of the body their proper form, and also defends the more delicate parts.

It perhaps serves to lubricate the interior parts. The omentum, in structure, very much resembles the subcutaneous fat, and probably renders the surface of the abdominal bowels slippery; as in the quadruped, it extends the whole length of the abdomen, but in man generally descends no lower than the umbilicus.

The fat, like other parts of the body, is constantly changing: it exudes, and is wasted by exercise, chiefly in consequence of the absorption of it by the lymphatic vessels.

Perhaps fat re-absorbed into the system may serve some very useful purpose in the animal economy.

Fat is very nutritious. Dr STARK lived for several months on suet and water, and was well nourished during that time, " but at last fell a martyr to Cheshire cheese."

Analogy seems to put this point beyond the reach of controversy. It has been observed, that dormant animals, though very fat at the commencement of winter, become very lean towards its conclusion.

The absorption of a considerable quantity of fat has been stated to communicate to the serum of the blood a whitish tinge.

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PART XXI.

CHAPTER I.

ORGANIC DERANGEMENTS OF THE MEMBRANES OF THE BRAIN, CEREBELLUM, AND SPINAL MARROW.

SECT. I.

OF THE ORGANIC DERANGEMENTS OF THE DURA MATER.

THE *Dura Mater* has sometimes been inflamed; it then acquires a pink colour; and there are many small vessels on its surface, which pass into the inner table of the skull. Small pieces of bone are occasionally formed upon the dura mater; these bones are commonly very thin, and have ragged edges.

Cauliflower-like excresences sometimes grow from the dura mater, where a violent blow upon the head has been received.

The portion of the skull over the tumour is destroyed, and the excrescence from the dura mater appears as an external swelling under the scalp.

The arachnoid coat of the brain is sometimes much thickened, in consequence of disease: in one instance I saw small pieces of bone on it.

The pia mater is sometimes, though rarely, inflamed; in which state its vessels are filled with florid blood; and according to Dr Baillie, "when the pia mater is inflamed to a great degree, pus is formed."

Scrofulous tumours have been described by Dr Baillie, as sometimes adhering to the inside of the pia mater.

Hydatids are sometimes attached to the pia mater.

Sect. II.

ORGANIC DERANGEMENTS OF THE BRAIN.

Inflammation of the brain is very rare in this country, excepting from external violence. The brain then becomes firmer, more solid, and darker coloured than natural.

Abscesses are sometimes found in the brain; more frequently in the cerebellum.

Gangrene of the brain has also been described.

Tumours of different descriptions have been observed in the substance of the brain; those which are white, firm and solid, are the most frequent.

Tumours of a cartilaginous consistence are frequently observed within the substance of the

brain: the ossification takes place in the centre, and gradually extends to the circumference of such tumours; and in a few cases I have seen such tumours entirely converted into bone.

A watery fluid is frequently collected within the ventricles of the brain, and sometimes, though rarely, between the membranes of the brain.

The quantity of watery fluid collected is very various, amounting in some instances to one or two ounces only, but in others to several pounds.

Children are sometimes born with this disease; the bones of the skull are disunited from each other, as in Plate xxii; and the head thereby attains an unnatural magnitude; the child in a few instances lingering under the disease for several months or years.

Such has usually been called the *chronic form of hydrocephalus.*

In other instances, the water is rapidly effused after the bones of the skull have been consolidated, and the patient generally dies in four or five weeks: this is the *acute hydrocephalus.*

There is a third and intermediate stage, which has not been described by any author with whose works I am acquainted. In this form of the disease, the sutures of the adult give way; the bones of the skull are separated; and the patient lingers under the disease for several months.

When a large quantity of water has been accumulated within the ventricles of the brain, these

attain a prodigious size, and the substance of the brain, bounding the ventricles, becomes unnaturally thin, and is not so readily torn as in the healthy state.

But when only a small quantity of water has been accumulated, I have generally remarked, that the brain was softer, of a paler colour, and more easily torn than in the healthy state.

Blood or serum is sometimes effused between the dura and pia mater, or within the substance of the brain or ventricles of that organ; and in some instances the blood is fluid, but in others firmly coagulated.

When the blood has been effused in consequence of external violence, the brain around the effused blood retains its healthy structure; but in other circumstances, the brain around the effused blood, loses its healthy organization, and frequently acquires the consistence of custard.

When blood has been effused upon the surface of the brain, I have sometimes observed a number of small exostoses, growing from the internal table of the skull; and, in a few cases, canals passing from the place where the blood had been effused, filled by yellow coloured serum.

Hernia of the brain sometimes occurs, from an aperture in the skull, the consequence of malconformation, disease, or trephining.

CHAPTER II.

OF THE ORGANIC DERANGEMENTS OF THE NOSE, AND SINUSES CONNECTED WITH IT.

THE nostrils of infants are sometimes closed by means of a membrane stretched across them.

The nose, from its situation, is much exposed to external injury: its cartilages are torn off or destroyed by lues venerea or cancer, or its bones may be broken in an oblique or transverse direction.

The mucous membrane, which lines the nose, is subject to the same organic derangements, as other mucous membranes.

It is frequently inflamed, by which it attains an unnatural thickness, and its surface becomes more red and spongy, than in the healthy state.

This inflammation is sometimes limited to the nose; on other occasions, it extends to the membrane which lines the frontal and maxillary sinuses.

The nose is also the seat of an herpetic affec-

tion, which is often of very considerable duration, attacking one side of the nose after the other, called by authors, *Noli me tangere.*

Polypi frequently are attached to the membrane of the nose; and these sometimes attain so large a size, as to project beyond the nostrils.

Those polypi which are found in the nose, are of different kinds, and similar to those which have been already described, as occupying the alimentary canal.

Inflammation of the membrane of the antrum maxillare, is by no means unfrequent; it is sometimes followed by ulceration: and suppuration: Tumours are occasionally found in the antrum; and these are accompanied by caries and erosion of the surrounding bones, and in such cases, the pus sometimes flows out at the angle of the eye, in the cheek, palate, or at the side of the grinding teeth.

Cysts containing a watery fluid, are sometimes met with in the antrum maxillare.

Worms have sometimes been found within the frontal sinuses and antrum.

The bones over the frontal sinuses have been often fractured, as also the os maxillare superius, by external violence.

CHAPTER III.

OF THE ORGANIC DERANGEMENTS OF THE EYE-BALL, AND ITS APPENDAGES.

THE eye-ball, being made up of parts of different structures, is liable to a great variety of organic derangements.

The sclerotic coat, the choroid coat, and optic nerves, are subject to particular organic derangements; and the eye-lids and lacrymal passages, to all the diseases of mucous membranes. Besides, diseases which were primarily limited to one part of the eye, are frequently communicated to the adjacent parts.

SECT. I.

OF ORGANIC DERANGEMENTS OF THE CORNEA.

THE *Cornea*, which is covered by the tunica adnata, is subject to inflammation, which some-

times appears in the form of a spot or speck, of which there are different descriptions.

The word *pterygium* has been employed to denote a red-coloured membrane, of a triangular shape, which generally grows from the internal angle of the eye, and extends over the margin of the cornea; the thickness also of the pterygium varies in different cases; most frequently it resembles a thin vascular membrane; at other times, it is like a fleshy tumour.

In consequence of inflammation, a dense lymph is sometimes effused between the layers of the cornea, which constitutes the disease called *albugo* or *leucoma*.

Fleshy excrescences sometimes grow from the cornea, and with hairs growing from the centre. Fungous tumours are sometimes, though rarely, connected with the cornea.

Pustules, which appear like yellow or red spots, somewhat elevated above the surface of the cornea, have been observed; and these are generally attended by inflammation, and an enlargement of the bloodvessels of the eye.

These pustules advance to suppuration; and in their centre there is often a white chalky substance. Blood or purulent matter have in some cases been collected between the layers of the cornea: when pus has been effused, the disease is termed *fungus*, and appears like a spot of a yellow colour.

Wounds inflicted on the cornea often occasion ulceration of it.

The cornea has been in some cases much extended; in some such cases it becomes harder, but in others softer than usual; it assumes a conical shape; projects considerably beyond the eye-lids, is opaque, of a pearly colour, and often adheres to the iris. This disease is called *staphyloma.*

In a few cases, the disease continues stationary; but in others the diseased cornea, probably in consequence of the stimulus of the air, and the friction of the eye-lids, to which it is continually exposed, becomes gradually more and more prominent, and in general more or less inflamed.

SCARPA, in his late Treatise upon the Diseases of the Eyes, has described what he has called the *staphyloma of the sclerotic coat.* In this disease, the posterior part of the sclerotic coat, at the side of the optic nerve, was elevated into an oblong tumour, which somewhat resembled a small nut.

The cornea is sometimes, though rarely, partially ossified: the bony scales are generally very thin, and lodged between the layers of the cornea.

Hairs sometimes grow from the cornea.

SECT. II.

OF INFLAMMATION OF THE EYE-BALL.

THE eye-ball is extremely subject to inflammation, which is sometimes limited only to the internal parts of the eye-ball, or chiefly to the retina.

When the inflammation is external, vessels filled by red blood are seen ramifying upon the cornea; and frequently there are little vesicles containing red blood upon the cornea, sometimes accompanied by the effusion of blood between the tunica adnata and sclerotic coat.

There is a kind of inflammation of the eye-ball, which is attended with the discharge of a yellow or greenish matter; and this form of the disease has been called the *purulent ophthalmia.*

It may be proper to add, that Mr JOHN PEARSON has described an ophthalmia, connected with the lues venerea, which bears a strong resemblance to the ophthalmia tarsi of scrofulous children.

SECT. III.

ORGANIC DERANGEMENTS OF THE HUMOURS OF THE EYE.

Of Organic Derangements of the Aqueous Humour.

IN consequence of violence, and inflammation, a yellowish glutinous fluid is effused into the aqueous humour of the eye, which constitutes the disease called *hypopium*.

SECT. IV.

OF ORGANIC DERANGEMENTS OF THE CRYSTALLINE LENS, ITS CAPSULE, AND THE FLUID BETWEEN THEM.

THE crystalline lens sometimes becomes opaque, and the disease has been called *crystalline cataract*.

Oculists have also described as the *membranous cataract*, an opacity in the capsule of the lens, and the epithet *interstitial* has been used when this is owing to an opacity in the fluid between the lens and its capsule.

The crystalline cataract often appears as an opaque spot behind the pupil, and the centre of

the lens appears thicker than its circumference, the latter of which frequently assumes the appearance of a dark or black ring around the lens.

The colour of the spot is various: it is either white or grey, and often the surface seems broken, like white clouds in summer, or there is an appearance of rays issuing as from a centre, when the diseased lens looks like a star.

Sometimes the cataract is of a dark brown, or green hue, when the eye is examined with great attention.

The colour of the cataract is in some cases characteristic of its consistence. While a cataract is soft, and the lens is larger than common, and seems to project beyond the pupil, the cataract is of the consistence of cream, and flows out when the capsule is punctured.

This species is sometimes congenite.

There are two varieties of this; one in which the capsule is thin and soft, the other, in which the capsule is firm; the latter has been called by RICHTER, *cataracta cystica.*

Those of a dark yellow, ash, or brown colour, are commonly firmer; and in some rare cases, according to WENNEL, are as hard as plaster of Paris.

The harder the cataract, the smaller it generally is; and sometimes the lens has been converted into bone.

Some cataracts are partly hard and partly fluid; sometimes fluid in the circumference, but solid in the centre, and also *vice versa.*

Sometimes the opacity is seated only in the capsule on the fore or back part, and then the capsule attains an unnatural thickness, and often contracts an adhesion with the iris.

While examining the lens, on supposition of cataract, we should bear in mind the change which the lens undergoes in figure and colour during the progress of life.

Some cataracts have a tremulous motion; and these are called by the French authors, *cataractes ebranlantes*.

Sect. V.

OF DROPSY OF THE EYE.

The vitreous humour is sometimes secreted in an unnatural quantity, which constitutes the disease called *dropsy of the eye-ball.*

The eye-ball attains an unnatural size; it projects forwards, and prevents the eye-lids from shutting; the eye-ball is kept in a state of constant irritation by dust, and by the eye-lashes; and hence this disease is generally accompanied by a greater or less degree of inflammation, and also sometimes by caries of the bones of the orbit.

SECT. VI.

ORGANIC DERANGEMENTS OF THE IRIS.

THE iris is frequently inflamed; it loses its healthy colour, becomes thickened, and the pupil is much contracted.

This inflammation is usually attended by an inflammation of the sclerotic coat; and when the disease is violent, lymph is effused on the anterior surface of the iris, and also between it and the crystalline lens; by which the light cannot reach the bottom of the eye.

From violent internal inflammation of the eye, the pupil has been completely closed; the iris is rendered immoveable, and assumes a radiated appearance.

It may not be improper to add, that in consequence of a wound or ulcer in the cornea, the iris has been sometimes protruded forwards through the cornea.

SECT. VII.

OF AMAUROSIS, OR PALSY OF THE OPTIC NERVE.

THE palsy of the optic nerve is not commonly attended by any manifest organic derangement of the optic nerve.

Sect. VIII.

CANCER OF THE EYE-BALL.

By this organic disease, the eye-ball is much enlarged; it assumes an irregular figure, and the vessels upon the fore-part of the eye are much enlarged; and upon making a section of the eye, there is little appearance of the organization of the eye, the eye-ball resembling a piece of indurated flesh.

When the disease has made progress, fungous excrescences frequently shoot out from the anterior surface of the eye, which degenerate into malignant ulcers.

Sect. IX.

OF FUNGUS HÆMATODES OF THE EYE-BALL.

In this disease, the eye-ball, which is not of its usual form, is filled by a soft substance, which in colour and consistence resembles the brain.

The sclerotic coat assumes a lead colour; the cornea ulcerates; and fungous excrescences, of a dark purple colour, which in many cases are filled by coagulated blood, protrude from the cornea.

The lymphatic glands in the vicinity of the eye, are considerably enlarged.

The optic nerve generally acquires a greater or less degree of induration, which sometimes extends as far as the thalami nervorum opticorum. I have also seen the optic nerve as it were split into parts, a morbid growth filling up the intervening spaces.

Sometimes there is a dark brown coloured substance, of the consistence of thick oil-paint, which tinges the medullary-like substance contained within the eye-ball; and the optic nerve is in some such cases tinged by the same dark brown coloured substance.

The lymphatic glands in the vicinity of the optic nerve, are similarly diseased, and in some cases even the more distant parts, as the liver, kidneys, or uterus.

CHAPTER IV.

OF ORGANIC DERANGEMENTS OF THE EYE-LIDS.

THE eye-lids are a frequent seat of inflammation, which often extends to the cheeks; and this inflammation is apt to become chronic.

Infants at birth are subject to an inflammation of the eye-lids, which is attended by a discharge of a thick yellow purulent matter.

Different kinds of tumours form on the eye-lids; of these, the little tumour or boil, or what has been called the *stye*, is the most frequent.

Warts sometimes grow on the eye-lids.

Encysted tumours, containing a watery fluid, are not uncommon upon the eye-lids.

The eye-lids are turned outwards or inwards upon the eye-ball. The former is most frequent in the under eye-lid, which is turned outwards towards the cheek: the disease has been called *ectropium*. In the latter disease, called *trichiasis*, the eye-lashes are turned inwards upon the eye-ball, which is thereby very much irritated.

Sometimes the upper eye-lid cannot be elevated. Sometimes the eye-lids cannot be shut.

CHAPTER V.

OF ORGANIC DERANGEMENTS OF THE CARUNCULA LACRYMALIS.

The caruncula lacrymalis becomes in some cases much enlarged, preventing the eye-lids from being closed; and in some cases exhibits a fungous

appearance. The disease has been called *Encanthis.*

This tumour is of an inflammatory nature, and frequently suppurates; but in other cases it remains for years in an indolent state.

CHAPTER VI.

OF FISTULA LACRYMALIS.

An obstruction to the flow of tears into the nose, occasions the distention of the lacrymal sac, and a sensible tumour at the internal angle of the eye.

On pressing this tumour, a clear liquor tinged by a viscid yellow fluid, is discharged through the puncta lacrymalia.

The lacrymal sac sometimes ulcerates, and its contents are discharged externally; and this is often attended by a caries of the os unguis.

Strictsre sometimes occurs in the Nasal Ducts.

CHAPTER VII.

OF THE ORGANIC DERANGEMENTS OF THE EAR.

The external ear is much exposed to external injury. When divided partially, it may be readily reunited.

The external ear has sometimes been much swelled in consequence of erysipelas, herpes, and other cutaneous disorders, especially during infancy; and insects and other extraneous bodies have sometimes stuck in the meatus auditorius externus.

Wax, which becomes very hard, is sometimes accumulated in such quantity within the external passage, and upon the membrane of the drum, as to occasion dullness of hearing.

The membrane of the drum is occasionally the seat of inflammation.

Polypi sometimes grow from the membrane of the drum.

There is in some instances an aperture in the membrane of the drum.

An unnatural membrane has occasionally been observed in the external passage of the ear.

Sometimes there is no external meatus.

The tympanum has sometimes been inflamed and ulcerated, in consequence of blows, small-pox, lues venerea, or scarlatina; and the chain of bones extended across it, has been cast out.

Obstructions in the eustachian tube have been observed in venereal ulceration of the throat, and also in the scarlatina maligna.

In cases of deafness, connected with a palsy of the branches of the portio mollis, there is no obvious organic lesion in the nerve.

Coagulable lymph has been found within the vestible of the ear.

The pars petrosa of the temporal bone, has been fractured in consequence of a fracture extending across the base of the skull.

CHAPTER VIII.

OF THE ORGANIC DERANGEMENTS OF THE SKIN.

In drawing out a short sketch of the diseases of the skin, I have availed myself of many of the

the observations of Dr WILLAN, and have added a very brief account of his method of arranging these.

Dr WILLAN has arranged diseases of the skin in eight orders.

ORDER 1.—PAPULÆ *, which comprise three genera, *strophulus, lichen*, and *prurigo.*

The *strophulus* is a papulous eruption, which exhibits a variety of forms, and which may be described under the titles, *strophulus intertinctus* or red gum, *albidus, confertus* or tooth-rash, *volaticus*, and *candidus.*

Lichen is defined by Dr WILLAN to be an extensive eruption of papulæ affecting adults, connected with internal disorder, and usually terminating in scurf; recurrent, but not contagious.

The varieties are the *simplex, pilaris, circumscriptus, agrius, lividus*, and *tropicus*, or prickly heat affecting Europeans settled in tropical climates.

Prurigo. Under this genus, Dr WILLAN has described the *mitis, formicans*, and *senilis.*

In the prurigo, the papulæ are larger than in the lichen, and have nearly the same colour as the skin.

* Papulæ are said by Dr WILLAN to be very small and acuminated elevations of the cuticle, with an inflamed base, not containing a fluid, nor tending to suppuration.

ORDER 2. comprehends SQUAMÆ *, or the scaly diseases of the skin, which arise from a morbid state of the cuticle. The generic diseases of this order, are *lepra*, *psoriasis*, *pityriasis*, and *icthyosis.*

The *Lepra* is characterised by scaly patches of different sizes, but nearly of a circular form. Of this, Dr WILLAN has observed three species, the *vulgaris*, *alphoides*, and *nigricans.*

The *vulgaris* exhibits small distinct elevations of the cuticle, which are reddish and shining, and never contain any fluid; and in twenty-four hours, these are covered by thin white scales.

In the *alphoides*, the scales are smaller, and their central parts are a little depressed.

In the *nigricans*, the colour of the patches differs from that of the preceding kinds; they are dark and livid, and are not depressed in the centre; and the skin appears of a livid colour through the scaly incrustations.

Psoriasis or *scaly tetter*. The species of this, described by Dr WILLAN, are the *guttata*, *diffusa*, *gyrata*, *palmaria*, *labialis*, *ophthalmica*, *præputii*, *scrotalis*, *unguium*, *infantilis*, *inveterata*.

* Dr WILLAN has thus defined a scale; a lamina of morbid cuticle; hard, thickened; whitish and opaque. Scales have at first the figure and extent of the cuticular lozenges, but afterwards often increase into irregular layers, called *crusts*, which repeatedly fall off, and are reproduced in a short time.

The following brief description may communicate a general idea of the disease.

The names express the form of the patches or stripes; their seat; the period of life at which they appear, or the inveteracy of the disease.

The complaint begins in small distinct scales, with little or no inflammation around them.

The patches are seldom as large as a sixpence: They have not an elevated border, and their circumference is angular.

Pityriasis consists of irregular patches of thin slight scales, which are repeatedly produced and separated, but never produce crusts. Dr WILLAN has described the *pityriasis capitis, rubra,* and *versicolor.*

Icthyosis is a permanently harsh, dry, scaly, and in some cases almost horny texture of the integuments, unconnected with internal disorder.

The 3d ORDER of Dr WILLAN comprehends the *Exanthemata* or *Rashes* *; some of which are contagious, others not, and some are attended by symptomatic fever: Some continue for a definite time; others return at uncertain intervals.

* Rash, according to Dr WILLAN, consists of red patches on the skin, variously figured; in general confluent, and diffused irregularly over the body, leaving interstices of a natural colour. Portions of cuticle are often elevated in a rash, so as to give the sensation of an uneven surface. The eruption is generally accompanied with disorder of the constitution, and terminates in a few days by cuticular exfoliations.

This order includes the *rubeola* or measles, *scarlatina* or scarlet fever, *urticaria* or nettle-rash, *Roseola*, *purpura*, and *erythema*.

Rubeola or measles. In this disease, small clusters of pimples appear on the fourth day, which after four days disappear in small mealy desquamations.

The pimples in different instances of this disease are more or less distinct; hence nosologists have made mention of the rubeola vulgaris, where the pimples are scarcely elevated, and the rubeola variolodes or measles, with distinct elevated pimples.

Urticaria or nettle-rash. In the second day of this disease, small round or oval red spots, with a white top, appear, and which are often surrounded by diffused redness, disappearing during the night, but returning at morning, and which in a few days go off in very minute scales. Sometimes the disease appears in the form of longitudinal elevations of the cuticle.

Scarlatina. On the fourth day of this disease, the face seems swelled; there are large red blotches on the skin, which coalesce and spread over the skin, or within the mouth and fauces; and these blotches of the skin are, in the course of three days, succeeded by furfuraceous scales.

There are three varieties of the disease:

1. That unaccompanied by cynanche.

2. That accompanied by ulcerous cynanche.
3. The scarlatina maligna.

Roseola. This term has been used to express a rose-coloured efflorescence of the skin, which is of various figures, and the patches are generally larger and more irregular than those of the measles. They are at first red, but soon assume the roseate hue peculiar to this complaint. The fauces are often tinged of the same colour, with a slight enlargement of the tonsils. The efflorescence appears first in the evening or during the night, and continues vivid through the following day. On the fourth day, only slight specks of a dark red colour are perceptible, which disappear on the fifth day.

In many cases, the eruption is limited to the face, shoulders or neck.

This is not an idiopathic disease; but is rather connected with fevers of different descriptions.

Dr Willan has described the following varieties of it; the *æstiva*, *autumnalis*, *annulata*, *infantilis*, *variolosa*, *vaccina*, and *miliaris*.

Purpura, or *Petechiæ sine Febre*.—The petechiæ sine febre, are small circular purple spots, about the size of a coriander seed, which appear suddenly and without fever, and go off slowly.

Erythema is described as synonymous with the Erysipelas according to Dr CULLEN's arrangement.

ORDER 4. *Bullæ* *. This order, according to Dr WILLAN, includes three genera; *erysipelas*, *pemphigus*, and *pompholyx*.

The skin is subject to inflammation or *erysipelas*, which is attended by redness, pain, heat and swelling, which rapidly spread from one part of the skin to another; and the peculiarities of this inflammation are entirely owing to the texture of the skin.

This inflammation terminates in vesications, desquamation of the cuticle, or gangrene.

This, like many of the other diseases of the skin, is attended by symptomatic fever.

The erysipelas is sometimes confined to the extremities of the body, sometimes to the head; which form of the disease has been called *sideratio*; or sometimes it spreads round the waist, which form has been called *zona* or *belt*.

Pemphigus. On the first, second or third day of this disease, vesicles appear, nearly of the size

* A large portion of the cuticle, detached from the skin by the interposition of a transparent watery fluid, is called by Dr WILLAN *bullæ* or *blebs*. He has added: "Soon after the water is discharged, the excoriated surface is covered with a flat, yellow, or blackish scab, which remains till a new cuticle is formed underneath. Both vesicles and blebs, when they have a dark red or livid base, are by medical writers called *phlyctænæ*."

of hazel-nuts; these continue for several days, and then burst and discharge a thin ichor.

These vesicles* sometimes appear a few days after birth; and when broken, are succeeded by ulceration.

Pompholyx. This eruption appears in the form of a tumour, filled by lymph, which is about the size of a pea, or in some cases of a hazel-nut; and tumours of this description frequently appear in succession, on the legs, arms, chin, temples, &c. They break in four days, and there is no pit or cicatrix left.

Of Herpes.

In the herpetic eruption, there is a small vesicle, with a thin scale at top; and the base is surrounded by erysipelatous inflammation.

Sometimes herpes appears under the form of flat patches, which are covered by small scales.

This form of the disease is very common on the scalp. When the scale falls off, the skin below is generally nearly sound, though somewhat discoloured.

The herpes also appears in the form of very small vesicles, like millet-seeds; which appear in clusters, and are filled by a viscid lymph, which exuding, forms rough yellow scabs;

* By *vesicles*, are meant tumours filled by a watery fluid; by *pustules*, tumours filled by pus.

and when the scab falls off, it is apt to be renewed.

This kind of herpes sometimes attacks the throat. Another kind of herpes has been called the *herpes exedens;* for it destroys the skin: sometimes it spreads along the surface, but in other cases penetrates deep.

Of Tinea Capitis.

The Tinea Capitis is a white or yellow scabby eruption of the hairy scalp, the consequence of inattention to cleanliness, and which often spreads over the whole head.

Of Impetigo, or Ring-Worm.

In this disease, there are a number of small red pimples, filled by a thin acrid fluid, which are disposed in a circular manner.

This disease, in some constitutions, becomes of an inveterate nature, and is diffused over the whole skin, like the lepra.

Of Psora.

This disease appears chiefly between the fingers, on the wrists, and on the folds of the elbow, shoulder, and knee joints, under the form of small

pimples or pustules, of which the base is hard, with a watery looking top.

When the pustules are broken, scabs are formed partly by blood, and partly by the matter from the pustules.

If the vesicles or pustules be not broken, they terminate by a slight desquamation of the cuticle.

Small boils sometimes appear in the course of the disease.

According to some authors, animalcula are seen in the pustules.

Of Pernio, or Chilblain.

The skin of the fingers or toes, which are affected by chilblains, assumes a deep purple or leaden colour. The skin breaks in some cases, and discharges a thin fluid; and in some cases mortifies and sloughs off, leaving an ill-conditioned ulcer.

Of Lepra.

In this disease, there are a number of copper-coloured spots over the whole body; these are in a great measure insensible.

The skin, when the disease has made progress, becomes rough and scaly, or is covered by warts; and fœtid sores sometimes break out in different parts of the body.

Of Elephantiasis.

This organic derangement of the skin has been called *elephantiasis*, as the part affected bears a strong resemblance to the skin of the elephant.

The disease is generally confined to one leg, but in some cases it extends to both.

The affected limb is much swollen, and often scaly, and covered by lumps, and a number of uneven fissures. According to some, the disease exists chiefly in the cellular substance.

Of Ecthyma, or Terminthus.

These terms have been applied to describe boils, which are often attended with considerable inflammation and suppuration.

The abscess having burst, a scab forms, and the inflammation subsides.

Aphthæ.

The little white specks, or vesicles, called *aphthæ*, have been already described, under the head of the Organic Diseases of the Alimentary Canal.

Condyloma.

A condyloma is a white warty excrescence, situated frequently near the pudenda.

These are frequently collected into clusters in those whose constitutions are deeply tainted by lues venerea.

Of Clavus, or Corns.

Corns are hard excrescences of the cuticle, of a laminated structure, which seem to be occasioned by pressure, and are most frequent on the toes.

These are hardest in the centre, often assume a conical figure, generally are moveable, but in some cases immoveable, from having contracted an adhesion with the tendons of the muscles, or with the periosteum of the bones.

Variola, or Small-Pox.

The variola, or small-pox, has been enumerated among the diseases of the skin.

A number of small red pimples shew themselves on the third day of this disease, which, in the course of eight days suppurate, and then fall off in crusts, leaving pits in the skin.

The species of this disease, are the Distinct and Confluent small-pox.

Varicella, or Chicken-Pox.

The vesicles in this disease, resemble very much those of the small-pox; the pustules, however, are filled by lymph, and they seldom suppurate; crusts appear on the fourth or fifth day, and in general no scar or pit is left behind.

The pustules are seldom, if ever confluent.

Dr Willan has described the Lenticular, the Conoidal, and the Swine or bleb-pox.

Of Vaccina, or Cow-Pox.

This disease appears on the teats of cows, in the form of small grey-coloured pustules, which are surrounded by an erysipelatous inflammation.

The disease is communicated to persons employed in milking the cows. Where the cuticle has been removed, small inflamed spots appear in a few days after exposure to the infection, which quickly assume the appearance of blisters, and then become large vesicles of a circular form, and with a depressed centre.

The lymphatic glands in the vicinity are affected, and there is an erysipelatous redness around the vesicles.

These vesicles, when irritated, sometimes run into foul ulcers.

The progress of the cow-pox is somewhat different, when it is received by inoculation with a lancet.

About the third day, a slight inflammation may be observed in the part inoculated; and it feels hard when the finger is drawn over it.

On the fifth day, a small circular vesicle shews itself, which is depressed in the centre, and turgid in its circumference.

During the sixth and seventh days, the vesicle increases in size, retaining its original characters; and on the eighth day the vesicle has a circular appearance, and the margin is regular and well defined; the centre is still more depressed, where a small crust begins to appear.

If the vesicle be punctured, all its contents are not discharged at once. The vesicle is composed of many cells, and somewhat resembles a honey-comb.

About the ninth day the vesicle is surrounded by a deep red coloured areola, which is to the touch hard; and about the same time an erysipelatous redness sometimes takes place around the areola, and spreads so as to cover a part of the skin of the arm, equal in bulk to a circle of two or more inches in diameter.

On the ninth day, the vesicle is of its largest size; and on the eleventh day the areola decreases, and the surface of the vesicle becomes brown in its centre, and a dark brown colour-

ed scab is formed, which falls off about the eighteenth or twentieth day.

Under the scab, there is a cicatrix.

From the eighth day, the glands in the axilla are a little swelled in inoculation, and this generally subsides with the affection on the arm.

Cancer of the Skin.

The skin is also subject to cancer.

The disease shews itself under the form of small superficial tubercles or warts, of a brown colour.

These warts are most frequent on the alæ nasi, lips, and eye-lids.

These tubercles often remain indolent for a time, and in consequence of being irritated, become extremely painful, generate cancerous matter, and pour out blood.

The tumour rapidly extends along the skin, and penetrates, in some cases, even to the bones.

Chimney-sweepers are subject to a particular kind of cancer in the scrotum, which has been described by Mr Pott.

Tumours of the skin, originating from an enlargement of the arteries or veins of the skin, also occur.

Small excrescences of a purple or blue colour are frequently observed in different parts of the skin; sometimes they are of a brown colour, rough, warty, and hairs grow from them. These have been called *nævi materni.*

The disease called *aneurism* by anastomosis, is originally a disease of the bloodvessels of the skin. The tumour is to the touch, elastic; it gradually enlarges, acquires a dark purple colour, and bleeds frequently; and I have observed, that, in some instances, it feels colder than the surrounding skin.

CHAPTER V.

OF THE ORGANIC DERANGEMENTS OF THE CELLULAR SUBSTANCE.

WATER and pus are frequently collected in the cellular substance, and sometimes air.

The most frequent organic derangement of the cellular substance is *phlegmon*, a tumour of a vivid red colour, with a circumscribed base, which rises into a point, and which frequently terminates in abscess.

In consequence of inflammation condensing the surrounding parts, and by the effusion of the coagulable lymph, a cyst is formed, which contains the purulent matter which has been secreted.

Abscesses frequently burst externally, in consequence of the absorption of that part of the cyst which is nearest to the surface of the body. The skin also gives way. But tendinous fasciæ are not

thus rapidly destroyed by absorption: hence the pus, when lodged under these, instead of being discharged externally, finds its way into the cellular substance, and among the surrounding muscles.

When an abscess is deep seated, it sometimes bursts externally by a small opening; and upon the matter being discharged, the orifice contracts; the edges of the canal become hard, or, to make use of the technical language, fistulous, by the habitual discharge from the deep seated abscess.

Carbuncle, a broad flat red tumour, may be enumerated among the organic derangements of the cellular substance, though by many it is enumerated among the diseases of the skin, which is very much thickened, and has at the same time a dark purple colour.

The surface of the tumour becomes dark and livid, and there is a number of small apertures, through which the contents of the tumour are discharged.

Of Encysted Tumours.

Encysted tumours of different kinds are lodged in the cellular substance, viz.:

Meliceris, an encysted tumour which contains matter of the consistence of honey.

Atheroma, an encysted tumour filled by a white pultaceous matter, like chalk and water.

Steatoma, an encysted tumour containing a substance like fat or suet.

Hydatis, are encysted tumour filled by a watery fluid and other smaller hydatis.

Ganglion, an encysted tumour connected with the tendons and ligaments, which is generally of an oval shape, and rarely exceeds a pigeon's egg in size.

Ranula, an encysted tumour under the tongue, which is frequently filled by a fluid like cream, or animal jelly.

Small encysted tumours, filled *by fat and hairs*, are sometimes met with in the cellular substance.

Fleshy and hard tumours, which have been called *sarcomata*, are occasionally lodged in the cellular membrane.

A worm, called *Gordius*, and also *Lice*, may be enumerated among the diseases of the skin and cellular membrane.

The *fungus hæmatodes* has sometimes been observed in the cellular substance: this disease sometimes begins as a distinct tumour, and sometimes as a general swelling of the part, and the veins in the neighbourhood of it are much enlarged: the swelling is to the touch, soft and elastic; and on the progress of the disease, bursts, and a dark fungous excrescence rises from the centre of it, which discharges a good deal of blood.

Upon dissection, a substance like brain is found to occupy the greater part of the tumour.

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PART XXII.

CHAPTER I.

OF THE DISTRIBUTION OF THE ARTERIES, VEINS, NERVES, AND LYMPHATIC VESSELS.

FROM the Pulmonary Artery and Aorta, all the arteries are derived: the former is connected with the anterior, and the latter with the posterior Ventricle of the heart.

SECT. I.

OF THE PULMONARY ARTERY.

THE origin of this artery from the heart has been described above. It ascends behind the breast-bone; and at the concave side of the arch of the aorta, divides into the Right and Left pulmonary arteries, which are unequal in size and length; the former being larger and also longer. These branches are subdivided into a number of very small branches, which are distributed, along with

the bronchi through the substance of the lungs, and form a network upon the cells of the lungs.

SECT. II.

OF THE PULMONARY VEINS.

THE *Pulmonary Veins* follow the same course as the arteries; are rather smaller than these; and at length are united into *four pulmonary veins*, which terminate in the posterior Auricle of the heart.

SECT. III.

OF THE AORTA AND CORONARY ARTERIES.

THE AORTA, immediately after its exit from the heart, is somewhat expanded. Behind the valves of the heart, two arteries, which are distributed upon the heart, called CORONARY, take their origin. The *right* coronary artery is the larger; it passes between the right auricle and ventricle, and divides into a number of small branches, which are distributed upon the flesh of the heart; and terminates at the apex of the heart. This artery detaches branches to the aorta, pulmonary artery, and to the auricle of the heart.

The *left* coronary artery passes between the left auricle and ventricle, and is subdivided into anterior and posterior branches, which are distributed on the left side of the heart.

The aorta, after having sent off the coronary arteries, rises upwards, and somewhat to the right side; then passes over the right branch of the pulmonary artery; it then forms an arch opposite to the two uppermost dorsal vertebræ, which passes over the left branch of the trachea, behind which it descends.

From the arch of the aorta, *three large trunks* usually take their rise; the *arteria innominata*, common to the right carotid and right subclavian arteries; and the *left carotid* and *left subclavian* arteries, which are separate trunks.

SECT. IV.

OF THE ARTERIES OF THE HEAD, AND SOME OF THOSE OF THE NECK.

THE head is supplied with blood by the CAROTID and VERTEBRAL arteries.

The CAROTID ARTERIES ascend on each side of the vertebræ of the neck, between the internal jugular vein and the trachea, and behind the external extremities of the sterno-mastoid muscles.

The CAROTID ARTERY generally divides, nearly opposite to the upper margin of the thyroid cartilage of the larynx, into two great branches, called the *external* and *internal* carotids. The EXTERNAL CAROTID passes behind the stylo-hyoid and digastric muscles, behind the angle of the lower jaw; and during the above course, the following considerable branches are derived from it.

The first branch, called *superior thyroid*, comes off at the place of division of the common carotid, descends, and suddenly divides into branches, which are distributed upon the sterno-mastoid and platysma myoides muscles, and upon the muscles which are fixed to the os hyoides, larynx, and the membrane of the larynx.

The trunk of the artery always communicates with the corresponding artery of the opposite side, and also with the inferior thyroid artery, a branch of the subclavian artery.

A number of small branches of this artery are distributed on the lobes of the thyroid gland.

The next considerable branch is the *lingual*, which passes over the corner of the os hyoides, and then under the hyoglossus and genio-glossus muscles to the tongue. There are several *small branches* sent off from this artery, viz. a *branch* to the constrictor medius of the pharynx; a *branch* to the hyoglossus and mylo-hyoideus mus-

cles; and a *branch*, called *ranine*, which passes under the middle of the tongue, to its point.

The *pharyngeal artery* arises a little above the lingual; and, dividing into *small branches*, supplies the pharynx and fauces with blood; and it enters the skull at the foramen jugulare, and gives branches to the dura mater, the external membrane of the brain.

The next branch, which is smaller than the preceding, is called the *ascending palatine*; it is covered by the styloid muscle, and is distributed upon the side of the pharynx, upon the tonsils, tongue, and inferior maxillary gland. Small branches are also sent to the stylo-hyoid, stylo-pharyngeus, and hyoglossus muscles.

The continuation of the carotid artery rises up upon the angle of the lower jaw, at the fore-part of the masseter muscle; and hence has been called the *angular*, *facial*, or *external maxillary artery*.

This artery sends off various small branches, which are distributed upon the muscles of the face: it ascends to the internal canthus of the eye, where it anastomoses repeatedly with the branches of the ocular and frontal arteries.

A large branch of this artery has been called the *inferior labial*. It supplies the parts of the under-lip, and anastomoses with the corresponding artery of the opposite side; and there are several small branches of it, which supply the buccinator muscle.

The next arteries sent off are called the *superior* and *inferior coronary*, which form an arterial circle around the lips. A few small branches are sent off from this artery, which supply the cartilages of the nose.

A branch called *posterior artery of the ear*, is derived from the external carotid; it is spent on the back-part of the ear.

The Occipital is a large branch of the external carotid: it is covered by the digastric muscle at its origin; it passes across the jugular vein, and between the mastoid process and first vertebra of the neck; in which course it is covered by the trachelo-mastoid, splenius, and complexus muscles, and at length subdivides into many branches, which are distributed upon the middle of the back-part of the head.

This artery also gives off branches to the digastric muscle, to the cervical glands, and anastomoses with the thyroid artery.

A branch of this artery, called *auricular*, supplies the lobe of the ear, the parotid gland, and upper part of the sterno-mastoid muscle.

A branch of this artery passes downwards, and is distributed upon the trachelo-mastoid muscle, and the other adjacent muscles.

The External Temporal Artery, is the next large branch of the external carotid artery: it is covered by the parotid gland, and afterwards passes between the jaw and the meatus auditorius exter-

nus; and as it lies under the skin, it has been called the SUPERFICIAL TEMPORAL ARTERY. From it the following branches take their rise: *a branch* to the parotid gland; *a small branch* to the masseter muscle, which anastomoses with the inferior labial artery; and there is *a branch* which crosses the face in company with the duct of the parotid gland, and communicates with the facial and internal maxillary arteries.

The DEEP TEMPORAL is sent off behind the condyle of the jaw, and passes under the aponeurosis of the temporal muscle. Small *branches* of this artery, called the *anterior auricular*, are distributed upon the fore-part of the ear.

The superficial temporal, after passing across the zygoma, divides into *anterior* and *posterior branches*.

The *anterior* supplies the skin and muscles of the fore-part of the head, and anastomoses with the ocular and facial arteries.

The *posterior* branch divides into a number of branches, which supply the back-part of the head, and communicates repeatedly with the branches of the occipital artery.

The last great branch sent off from the external carotid artery, has been called, on account of its situation, the INTERNAL MAXILLARY ARTERY, as it takes its rise from the external carotid artery, behind the upright plate of the under jaw, between the condyloid and coronoid processes of that bone.

This artery is placed between the under jaw-bone, and the external pterygoid muscle, and then ascends towards the back-part of the antrum maxillare; and from it are derived the following branches:

A *branch* which enters the cavity of the tympanum by the fissure of GLASSER; a *branch* which passes through the spinous hole of the sphenoid bone, and is distributed upon the middle of the dura mater.

A *branch* of this artery enters the under-jaw along with the third branch of the fifth pair of nerves, and is distributed upon the under jaw and teeth, and then comes out at the anterior mental hole, to be distributed on the incisor teeth, and muscles of the chin; and anastomoses with the inferior labial artery.

Several *small branches* of the internal maxillary artery are spent upon the pterygoid muscles, alveolar processes, teeth, and antrum.

A *branch* of the internal maxillary, passes in the canal under the orbit; supplies the fat in the bottom of the orbit; passes out at the foramen infra-orbitarium, and then divides into many small branches, which communicate with the branches of the fascial artery.

The PALATO-MAXILLARY ARTERY, which passes through the foramen palatinum posterius, is distributed on the palate: and a branch of it sometimes passes through the foramen incisivum to the nose.

The LATERAL NASAL ARTERY, is also derived from the internal maxillary: it passes through the spheno-palatine hole to supply the nose and pituitary membrane which lines the nose, the ethmoidal cells, the septum narium, the ossa turbinata, antrum maxillare, and communicates with the palato-maxillary artery.

SECT. V.

OF THE INTERNAL CAROTID OR CEREBRAL ARTERY.

THE INTERNAL CAROTID ARTERY, follows a tortuous course upon the rectus capitis major muscle, before entering the carotid canal.

The artery having passed through the above canal, is directed upwards; then turns horizontally; enters the cavernous sinus, and perforates the dura mater, at the side of the anterior clinoid process of the sphenoid bone.

This artery sends small *branches* to the dura mater, to the cavernous sinus, and small *branches* which accompany the third, fourth and fifth pairs of nerves.

When the internal carotid artery has perforated the dura mater, it sends off the OCULAR, or OPHTHALMIC ARTERY.

This artery, situated on the outer side of the optic nerve, gives off a branch *to the lacrymal gland*; very small *branches* to the periosteum of the orbit; a branch which passes through the centre of the optic nerve, called Central Artery of the Retina, and which, on the inner side of the retina, divides into many branches, which, in the fœtus, may be distinctly traced to the capsule of the crystalline lens; as also the *ciliary arteries*, which, being unequal as to length, have been divided into the *longiores* and *breviores*.

The *ciliares longæ*, pass through the sclerotic coat, pass along the choroid, and then subdivide into two branches, and anastomose with the corresponding arteries of the opposite side of the eye at the root of the iris.

The *ciliares breves*, or *posteriores*, pass through the sclerotic coat of the eye-ball, near to the optic nerve.

At the circumference of the iris, the corresponding ciliary arteries of the opposite sides are united, and form a circle, called the *arterial circle of the iris*, from which a great number of small branches run towards the pupil, and many of them unite into arches, from which a number of small arteries are sent to the inner edge of the pupil.

The muscles which move the eye-ball, and the fat in the orbit, are also supplied with blood by the smaller branches of the ocular artery.

There are also small branches of the ocular artery, which enter the nose, by the foramina or-

bitaria interna, and which anastomose with the branches of the internal maxillary artery, which are distributed upon the inside of the nose.

There is also a branch called *Supra-Orbitar*, or in some cases branches called *Supra-Orbitaria*, of the ocular artery, which fill the foramina supra-orbitaria, and which are distributed upon the anterior part of the occipito-frontalis muscles, the skin and muscles of the upper eye-lid, and which anastomose with the anterior branches of the temporal artery. There are branches of this artery which supply the periosteum of the os frontis, and frontal sinuses.

The other, and smaller branches of the internal carotid arteries, are distributed upon the optic nerves, the infundibulum, and the choroid plexuses.

There are two other large branches of the Internal carotid artery, the Arteriæ Anteriores Cerebri, and the Arteriæ Mediæ Fossæ Sylvii.

The ARTERIÆ ANTERIORES CEREBRI, are disposed in a parallel manner in respect to each other: they run forwards along the under parts of the anterior lobes of the brain, and communicate by means of a transverse canal.

Each branch is afterwards subdivided into two branches; the smaller is spent entirely upon the anterior lobes of the brain; the larger is reflected backwards along the corpus callosum, and is divided into a great number of small branches, which anastomose repeatedly with the smaller

branches of the former artery; and many of the smaller branches dip into the substance of the brain, and supply its cortical and medullary part.

The Arteriæ Mediæ Cerebri, or arteriæ mediæ fossæ Sylvii, are larger than the arteriæ anteriores. These arteries are lodged in the fossæ Sylvii, extend obliquely outwards, and their innumerable branches supply the middle and posterior lobes of the brain, and anastomose with the branches of the anterior arteries, and also with those of the vertebral arteries.

A few of the smaller branches of these arteries perforate the substance of the brain, supply the anterior cornua of the lateral ventricles, and also concur in forming the choroid plexuses.

The brain also receives blood by the medium of the vertebral arteries, branches of the subclavian artery.

The *vertebral arteries*, after having entered the head, detach large branches, which joins with similar branches of the *anterior artery* of the brain, and form an *arterial circle* around the sella turcica, which has been named the Arterial Circle of Willis.

SECT. VI.

OF THE VEINS WHICH CORRESPOND WITH THE BRANCHES OF THE EXTERNAL CAROTID ARTERY.

THE smaller veins of the head follow a similar course with the branches of the external carotid arteries.

The trunk of the facial vein, is formed by a number of small veins, which are distributed upon the side of the face, and by the frontal vein.

The branches of the temporal, frontal and occipital veins unite; and the trunk thus formed, descends within the parotid gland, and is inserted into the facial vein at the lower part of the under-jaw, and opens into the external jugular vein, which also receives the branches of the internal maxillary, lingual and occipital veins.

The trunk of the external jugular vein lies beneath the platysma myoides muscle, passes down the neck, and terminates in the subclavian vein.

There is much variety as to the course of the jugular vein in different individuals.

There is another vein, called the *anterior external jugular*, situated on the fore-part of the neck, which receives branches from the neigh-

bouring parts, and usually terminates in the subclavian vein.

Sect. VII.

OF THE VEINS WHICH CORRESPOND WITH THE BRANCHES OF THE INTERNAL CAROTID AND VERTEBRAL ARTERIES.

The larger veins of the brain do not follow a similar course with the arteries, but pass between the convolutions of that organ, and terminate in the venous sinuses, with their orifices directed obliquely forwards, lest the blood should flow backwards from the venous sinuses, into the smaller veins of the brain.

The principal venous sinus has been named the *superior longitudinal*, the situation of which has been above described. It divides opposite to the middle of the occipital bone into the *lateral sinuses*. The blood from the lateral ventricles, choroid plexuses, corpora striata and septum lucidum, flows into the *torculor Herophili*, and from it into the beginning of the lateral sinuses; and from the lateral sinuses into the internal jugular veins.

The veins of the dura mater accompany the arteries of that membrane, and terminate in the external or internal jugular vein; and a few of the veins open into the sinuses of the brain.

The blood from the eye-ball returns to the heart partly by the medium of the facial vein, which communicates with the veins at the inner corner of the eye, and partly by the ocular veins.

The principal ocular vein is formed by the central vein of the retina; by the ciliary, lacrymal, and ethmoidal veins, which correspond with the arteries distributed on the muscles of the eyes.

The veins which correspond with the ciliary arteries describe nearly semicircles; meet in a centre, and form a trunk, which perforates the sclerotic coat, and the several trunks of the veins formed in the above manner open into the ocular vein.

The ocular veins which anastomose with the facial veins at the inner angles of the orbits, lead into the *circular sinuses* of RIDLEY, placed around the glandula pituitaria, from which the blood flows into the *cavernous sinuses;* and by the medium of the superior and inferior petrosal sinuses, the former of which, is situated upon the ridges, and the latter, at the basis of the partes petrosæ, reaches the extremities of the *lateral sinuses* and internal jugular veins.

The *anterior superior*, and *anterior inferior occipital sinuses*, placed upon the cuneiform process of the occipital bone, communicate with the inferior petrosal and lateral sinuses, and with the vertebral veins.

Besides the above sinuses, there is frequently found a *perpendicular occipital sinus*, situated in the falx cerebelli, which is sometimes double.

The lateral sinuses pass out from the skull at the foramina lacera posteriora in basi cranii, and join with the internal jugular veins, and are inclosed in the same cellular sheath as the carotid arteries.

The internal jugular veins receive the internal maxillary veins, the occipital, lingual, pharyngeal, superior and inferior laryngeal veins; and a few branches from the muscles of the neck, and at last terminate in the subclavian veins.

Sect. VIII.

OF VARIETIES AS TO THE ORIGIN AND COURSE OF THE ARTERIES OF THE HEAD AND NECK.

There are generally three large arteries, which take their rise from the arch of the aorta; the Arteria Innominata, common to the right Carotid and Subclavian arteries; the Left Carotid, and Left Subclavian, which come off by separate trunks.

In a very few cases, four arterial trunks take their rise from the arch of the aorta; and in some cases only two.

There is also considerable difference as to the length of the arteria innominata; in general, when

it has reached to the top of the breast, it divides into two great branches, the Right Carotid and Right Subclavian arteries: but in some cases the arteria innominata is much longer, and runs along the front of the windpipe.

In the annexed Plate XLIII., a singular distribution of blood-vessels is represented; the carotids came off by separate trunks from the aorta, as also the right and left subclavian arteries, and the subclavian of the right side passed behind the trachea.

In a few cases, both carotid arteries take their rise from the arteria innominata, and the left carotid crosses the windpipe considerably above the sternum.

The common carotid artery sometimes divides opposite to the fourth or fifth cervical vertebra, into the external and internal carotids; and in some cases, (as in a specimen I saw in the Museum of Mr A. BURNS of Glasgow,) the common carotid, instead of dividing into two great branches, divides into a number of small branches.

Mr BURNS shewed me another preparation, in which the carotid artery, opposite to the styloid process, divided into two large arteries; the internal carotid, and a trunk which is common to the temporal and maxillary arteries; and there were several branches sent off instead of the external carotid.

There is great variety as to the place of the origin of the superior thyroid artery; it commonly is derived from the external carotid, but in many cases from the common carotid.

There are innumerable varieties as to the origin and course of the smaller branches of the carotid arteries.

Explanation of Plate XLIII.

The figure in this Plate represents a deviation from the usual distribution of the branches of the arteries, which take their rise from the arch of the aorta.

A The arch of the aorta.

B The right carotid artery.

C The left carotid artery.

D The right subclavian artery, which took its rise from the arch of the aorta, a little below the left subclavian, passed behind the other three large arteries, and also behind the trachea, marked by letter F.

E The left subclavian artery.

GG The vertebral arteries.

HH The divided portions of the breast-bone.

K The larynx.

SECT. IX.

OF THE LYMPHATIC VESSELS OF THE HEAD AND NECK.

THE lymphatic vessels of the head are smaller than those of the extremities of the body; and but few of them have been filled with mercury by the British anatomists. MASCAGNI, in his Plates 24. and 26., has represented a number of lymphatic vessels upon the upper part of the head, the face, and also on the back part of the head.

There are several lymphatic vessels which follow the course of the temporal artery, and which pass through small glands connected with the parotid gland.

Some lymphatic vessels also accompany the occipital arteries, which enter a few small glands situated behind the root of the ear and the mastoid process of the temporal bones; and another cluster is placed at the nape of the neck.

The lymphatic vessels of the face lie in contact with the facial artery and vein; and those of the deeper parts accompany the internal maxillary artery, and pass through glands situated below the angle of the lower jaw.

The lymphatic vessels of the eye-ball have not been demonstrated; but in diseases of the eye-

ball, one or two small lymphatic glands have been observed at the side of the optic nerve. The lymphatics of the tongue pass into glands placed behind the angle of the jaw.

The lymphatic vessels of the brain have been represented by MASCAGNI; but they have not been seen by any other anatomist *.

The superficial and deeper-seated lymphatic vessels of the head pass downwards to the glands which are placed in the vicinity of the internal jugular and carotid arteries.

These glands are large and numerous, and collected into clusters; and have been named the *Glandulæ concatenatæ colli.* The lymphatic vessels from these are joined by several lymphatic vessels from the deeper parts of the thorax, and unite into a lymphatic trunk, which on the left side of the body enters the thoracic duct near to its termination; and on the right side, goes into a small short trunk, called the Duct of STENO.

A few of the lymphatic vessels sometimes open into the internal jugular vein, or into the subclavian veins, near to the junction of the internal jugular and subclavian veins †.

* The lymphatic vessels of the brain and organs of the senses of the skull, were discovered by my Father, and are represented in his book on Fishes.

† Vid. Observations on the Absorbent or Lymphatic Vessels of the Encephalon of the Infundibulum and Glandula Pituitaria, in my Father's book on the Nervous System, p. 17.; in his book on Fishes; and in his Treatise on the Brain.

SECT. X.

OF THE NERVES OF THE HEAD AND NECK.

IN describing the external organs of the senses, the following nerves have been described:

The *first*, or *Olfactory Nerves*; the *second pair*, or *Optic Nerves*; *the third pair*, or *Oculorum Motores*; the *fourth pair of Nerves*: the *first Branch of the fifth pair*; the *sixth pair of Nerves*; the *Portio Mollis of the seventh pair*; the *Lingual Branch of the eighth pair*; and the *ninth pair of Nerves.*

Of the Second Branch of the Fifth Pair.

The *fifth pair* of nerves divides into the following branches: The Orbitar, the Superior and Inferior Maxillary branches.

The first branch of the fifth pair has been already described.

The second part of the fifth pair, which is rather larger than the first, passes through the foramen rotundum of the sphenoid bone. From this the following nerves are derived:

1st, The *lateral nasal* branch, which passes through the spheno-palatine hole, and is distributed upon the under and back part of the sep-

tum narium, upon the eustachian tube, membrane of the sphenoidal sinus, and the membrane of the mouth: a branch of this nerve is reflected through the pterygoid hole of the sphenoid bone, and joins the sympathetic nerve in the carotid canal; and a branch of this nerve enters the foramen innominatum of the pars petrosa, and joins with the lingual branch of the seventh pair.

2d, The *palato-maxillary* branch, which passes through the foramen palatinum posterius, supplies the roof of the mouth, teeth, and back part of the superior maxillary bone.

3d, A branch, called *infra-orbitar*, which passes through the infra-orbitar canal; and during its passage, gives off several small branches, which are distributed upon the antrum maxillare, and the teeth.

This nerve, upon its exit from its bony canal, divides into a great number of small branches, which are distributed upon the cheek, under eyelid, upper side of the nose, and it joins with the portio dura of the seventh pair.

Of the Third Branch of the Fifth Pair of Nerves.

The *third branch* of the *fifth pair* or the *inferior maxillary nerve* passes through the oval-shaped hole of the sphenoid bone; sends off branches to the pterygoid and masseter muscles; and branches which accompany the superficial temporal artery; a branch to the point of the tongue, which also

supplies the inferior maxillary gland, the sublingual gland, and muscles of the tongue.

The main trunk of the nerve passes between the pterygoid muscles, and afterwards reaches the hole between the coronoid and condyloid processes of the under-jaw; and from this nerve, while in the inferior maxillary canal, a number of small nerves are derived, which enter the teeth of the under-jaw.

The continuation of this nerve passes outwards through the anterior mental hole, and is distributed upon the muscles of the fore-part of the chin.

Of the Portio Dura of the Seventh Pair.

The Portio Dura of the seventh Pair of Nerves, takes its origin from the pons Varolii and medulla oblongata. It is disunited from the portio mollis at the bottom of the meatus auditorius internus, and enters the aqueduct of Fallopius, where it receives a retrograde branch of the fifth pair, which has passed through the foramen innominatum, on the anterior plane of the pars petrosa. Before leaving this aqueduct, it gives off the chorda tympani, which passes between the long process of the malleus and incus, and along the membrane of the drum, and afterwards in a fissure at the outside of the eustachian tube. This nerve also forms a junction with the lingual branch of the fifth pair; and from it, branches are derived, which supply the muscles of the malleus.

The portio dura then leaves the aqueduct, passes through the foramen stylo-mastoideum, from which a number of small nerves issue out, which supply the parotid gland, the muscles of the eye-lids, face, and neck, and which join with those of the superior maxillary nerve upon the face *.

Of the Eighth Pair of Nerves.

The Eighth Pair of Nerves takes its rise by several roots from the bases of the corpora olivaria, and consists of two parts, the *par vagum* and *glosso-pharyngeus*; the latter has been already described.

The Par vagum, descends in the same cellular sheath with the jugular vein, and common carotid.

From the par vagum, the following branches are derived:

1. The PHARYNGEAL BRANCH, the branches of which, supply the posterior part of the constrictor muscles of the pharynx, and other branches join

* Vid. MONRO's Nervous System, p. 43. "The most remarkable connection of this kind is in the human face, where the portio dura of the auditory nerve is joined to the second and third branches of the fifth pair of nerves. Many of these nerves joined, are so small, that it is difficult to trace the fibrils of which they consist; but, in the larger branches, both in man and in the ox, I have certainly found, that the smaller branches which come off beyond the union of two larger nerves, consist of fibres from both."

with the laryngeal nerve, and with the accessory nerve and sympathetic.

2. The Superior Laryngeal Branch, which divides into an external and internal branch; the former of which, joins with the intercostal nerve. The interior branch creeps along the margin of the thyroid cartilage, and its branches are distributed upon the epiglottis, the membrane of the pharynx, the arytenoid muscles and arytenoid gland. The exterior branch anastomoses with a ganglion of the sympathetic; and from this junction of nerves, small branches are sent, which supply the constrictor muscles.

The eighth pair also sends branches which unite with the Sympathetic Nerve in the upper part of the chest, from which small nerves are sent to the heart.

There is a large branch of the eighth pair, which takes a retrograde course; on the right side it passes behind the subclavian artery, and on the left behind the trunk of the aorta; called the *recurrent*.

The recurrent branch of the eighth pair is joined with several branches from the ganglia of the sympathetic nerve.

The recurrent branches of the eighth pair ascend, and send branches to the trachea, to the œsophagus, and to the thyroid gland.

The continuation of the recurrent nerve unites with the superior laryngeal nerve; and after the union of these nerves, there are many branches sent

to the arytenoid muscles, and to the internal membrane of the larynx.

Of the Ninth Pair of Nerves.

The Ninth Pair of Nerves has been already described, with the exception of the branch of this nerve, called the *descendens noni*, which is derived from the branch of that nerve situated between the internal jugular vein, and internal carotid artery, and which then crosses over the carotid arteries.

This branch passes down along the common carotid artery, gives branches to the omo-hyoid and sterno-thyroid muscles, and afterwards joins the second and third cervical ganglion.

Of the Sympathetic Nerve.

The Sympathetic Nerve forms a plexus with the fifth and sixth pairs of nerves, upon the surface of the internal carotid artery, while it is placed in the carotic canal. The sympathetic is distinguished from the other nerves of the neck by its ganglia *. The eighth and ninth pairs of nerves pass into the uppermost cervical ganglion, situated opposite to the second vertebra of the neck.

The sympathetic nerve descends behind the eighth pair of nerves, and forms a second ganglion,

* Vid. Tab. xi. of my Father's Obs. on the Nervous System.

and a third ganglion opposite to the head of the first rib.

There are branches derived from the upper ganglion, which join with the sub-occipital nerve, and others, which, with small nerves derived from the glosso-pharyngeus nerve, form a plexus which covers the external carotid artery. A few nerves connect the uppermost ganglion of the sympathetic nerve with the first and second cervical nerves.

From the ganglia of the sympathetic nerve, small nerves are derived, which creep along the trunks of the subclavian artery and aorta, to the heart.

Of the Accessory Nerve.

The accessory nerves arise from the sides of the medulla oblongata, and spinal marrow, and pass out at the foramen lacerum in basi cranii, along with the par vagum of the eighth pair. This nerve is connected by filaments to the posterior bundle of some of the spinal nerves.

The accessory nerves are then detached from the eighth pair, and perforate the sterno-mastoid muscles, and terminate on the trapezius muscle.

There is a branch of this nerve which is sent off before it perforates the sterno-mastoid muscle, which assists in forming the pharyngeal nerve.

Sect. XI.

OF THE SPINAL MARROW.

The spinal marrow is contained within the spine, and, like the brain, is covered by the *dura mater*, the *arachnoid coat*, and *pia mater*; and from its sides, nerves in pairs are derived, which pass under each of the true vertebræ, and under the five pieces of which the os sacrum originally consists.

The arachnoid coat is closely connected with the pia mater by cellular substance; and its outer part is connected with the dura mater between each pair of its nerves by sharp-pointed membranes, resembling the teeth of a saw, which are said to form a *ligamentum denticulatum*.

The spinal marrow is flattened before and behind with transverse folds on it, and is composed of two chords, each of which is subdivided, and consists, like the brain, of cineritious as well as of medullary matter, but the former is *internal*; and hence, upon dividing transversely the spinal marrow, its internal cineritious substance has a cruciform appearance.

Every nerve derived from the spinal marrow consists of an Anterior and Posterior bundle of nervous fibres, each of which has its proper hole in the spinal marrow; on the outer side of which they are involved in a common sheath; and when this has been dissected with care, a ganglion is discovered in the posterior bundle.

The spinal marrow terminates in a conical point, about the lower part of the second lumbar vertebra.

The nerves connected with the spinal marrow become longer as we follow them within the dura mater, from the head downwards to the lower end of the spinal marrow. The nervous filaments, under the termination of the spinal marrow as a single chord, or lower than the second lumbar vetebra, on account of their length, are disposed in a parallel manner in respect to each other, and somewhat like the hairs in a horse's tail; hence that portion of the spinal marrow has been called *cauda equina*.

The posterior branches of the spinal marrow in the neck, are connected to each other by smaller nerves.

On the outside of the dura mater, the spinal nerves are connected on their fore-part to a nerve called the *great sympathetic nerve*, and joined to each other by large arches, from which the muscles of the head, trunk and extremities, are successively supplied.

Bloodvessels of the Spinal Marrow.

The bloodvessels of the spinal marrow are derived from the vertebral, intercostal and lumbar arteries.

The anterior spinal arteries take their rise from the vertebral arteries, descend along the whole of the anterior surface of the spinal marrow, and in the neck anastomose with the thyroid and cervical arteries, in the back with the intercostal and lumbar arteries.

The posterior and smaller arteries of the spinal marrow, are derived from the inferior cervical arteries of the cerebellum, or from the trunks of the vertebral arteries within the skull.

These arteries of the spinal marrow are subdivided into very small branches, which are distributed upon the medulla and its membranes *.

* Vid. A more full description of the spinal marrow in my Father's Treatise on the Nervous System, p. 28, 39, &c.
Vid. also Tab. x. affixed to the Nervous System.

SECT. XII.

VEINS OF THE SPINAL MARROW.

THE Veins of the Spinal Marrow accompany the arteries, and end in the venous sinuses of the spine, which extend from the foramen magnum of the os occipitis to the under end of the os sacrum, and are lodged in the ligamentous membrane, which lines the vertebral canal.

CHAPTER II.

OF THE BLOODVESSELS, NERVES, AND LYMPHATIC VESSELS OF THE SUPERIOR EXTREMITY.

SECT. I.

OF THE SUBCLAVIAN ARTERY AND ITS BRANCHES.

THE right subclavian artery takes its rise in common with the right carotid: the common trunk,

named *arteria innominata,* which is about two inches long, ascends and crosses over the fore-part of the right side of the trachea; after which, it divides into the subclavian and carotid arteries. The left subclavian is derived immediately from the arch of the aorta; it ascends, and then passes outwards at the under part of the neck, behind the sternal extremity of the sterno-mastoid muscle.

The branches of this artery, are, *first,* The INTERNAL MAMMARY, which passes behind the articulation of the clavicle with the breast-bone; and opposite to the inferior laryngeal artery, descends between the pleura and cartilages of the true ribs, and between the sterno-costalis and intercostal muscles.

The branches of the internal mammary artery, are,

1. Small branches to the thymus gland.
2. A branch which follows the same course as the phrenic nerve, and which terminates upon the diaphragm.
3. Small branches to the mediastinum and pericardium.
4. Branches to the intercostal muscles, and the integuments of the breast.
5. A branch, called *musculo-phrenic,* which, at the under part, is proper to the diaphragm.

The internal mammary artery, then emerges from the thorax, under the cartilage of the seventh

rib, and, upon the back-part of the rectus muscle of the abdomen, anastomoses with the epigastric arteries.

The *Inferior Thyroid*, or *Laryngeal Artery*, arises very near to the vertebral and internal mammary arteries.

This artery gives branches to the trachea; to the thyroid gland; to the larynx, pharynx and œsophagus, and it anastomoses with the superior laryngeal artery.

The subclavian artery bends outwards, and passes between the anterior and middle scaleni muscles, and then sends off the following branches.

The CERVICALIS ANTERIOR, which is covered by the sterno-mastoid muscle, passes upwards, and suddenly divides into branches, which supply the muscles of the trunk of the body which are fixed into the occiput.

The other and deeper branches of this artery anastomose with the occipital and vertebral arteries.

The CERVICALIS POSTERIOR, which takes its rise in common with the anterior cervical and inferior thyroid arteries; ascends on the posterior part of the neck; anastomoses with the occipital and vertebral arteries, and sends branches to the scaleni muscles, to the spinales colli, splenius, and trachelo-mastoidei muscles.

The next artery which is derived from the subclavian, has been named the DORSALIS SCAPULÆ

superior: it passes transversely behind the origin of the sterno-mastoid muscle, and then through the notch in the superior costa of the scapula, and divides into many branches, which are distributed upon the dorsum of the scapula, and also gives branches to the shoulder-joint.

The SUPERIOR INTERCOSTAL ARTERY, is also a branch of the subclavian: it descends over the heads of the first and second ribs, and gives branches to the gullet, and spinal marrow. Branches of this artery are distributed upon the first and second intercostal spaces, and anastomose with the inferior intercostal arteries.

The subclavian arteries pass behind the clavicles, and over the first ribs, into the axillæ, are surrounded by the axillary plexuses of nerves, lymphatic glands, and fat, and called AXILLARY ARTERIES.

The first branches of these, have been called the EXTERNAL THORACIC, or MAMMARY *arteries*.

The first from these, called *thoracica superior*, *longa*, and *humeralis*, supplies the serratus, intercostal, and pectoral muscles; the second goes to the axillary glands, to the mammæ, and the pectoral muscles; and the third supplies the capsular ligament of the shoulder-joint, and anastomoses with the scapulary arteries, and supplies the deltoid, greater pectoral, and subclavian muscles. A few of the smaller branches of this artery extend to the lowest

part of the scapula, and supply the latissimus dorsi, and subscapulary muscles, with blood.

The axillary artery passes along the origin of the subscapulary muscle, and gives off a large branch, named INFRASCAPULARIS; which divides into two great branches, the *scapularis interna*, and *arteria dorsalis scapulæ inferior*.

The SCAPULARIS INTERNA, passes downwards to the under part of the scapula, giving branches to the teres major and subscapularis muscles; and some of its branches anastomose freely with the arteria dorsalis scapulæ superior.

The DORSALIS SCAPULÆ INFERIOR, winds round the neck of the scapula to the back-part of that bone, is covered by the infraspinatus muscle, and inosculates, upon the fossa infra spinata, with the branches of the superior scapulary artery.

The next considerable branch, has been named the ARTICULARIS *posterior*, which takes its rise between the subscapularis and teres major muscles, and then passes around the posterior part of the os humeri, between that bone and the long head of the triceps, and the deltoid muscles. From this trunk, several small branches of arteries take their rise, which are distributed upon the capsular ligament, the biceps, coraco-brachialis, and subscapulary muscles.

The CIRCUMFLEXA ANTERIOR, is also a large branch of the axillary artery. It passes transversely between the coraco-brachialis muscle and biceps,

around the fore-part of the neck of the os humeri, and distributes its branches to the biceps, coraco-brachialis and deltoid muscles, to the capsular ligament of the shoulder-joint, and to the periosteum of the bone.

The axillary artery leaves the axilla, advances towards the front of the arm, and pursues its course, covered by the tendinous aponeurosis of the arm, along the inner side of the biceps, and over the brachialis muscle; and is then named *humeral artery*.

The smaller branches sent from this artery go to the biceps, coraco-brachialis and brachialis internus muscles.

A branch, named the PROFUNDA HUMERI, takes its rise near to the insertion of the teres major muscle into the humerus; it follows a spiral direction around the os humeri, between the long and short head of the triceps muscle; then comes out at the back of the arm, and divides into two branches, which communicate with reflected branches of the radial, ulnar and interosseous arteries.

The smaller branches of this artery pass upwards, and anastomose with the other branches of the scapulary and humeral arteries.

There are *several smaller arteries* sent off from this artery to the neighbouring muscles in its course along the os humeri.

The next considerable branch has been called PROFUNDA INFERIOR or MINOR.

This artery takes its rise from the outer side of the trunk near to the middle of the arm, and passes downwards to the external condyle of the humerus, supplying the neighbouring parts with blood.

The branch which supplies the os humeri, called *nutrient*, is sent off about the middle of the humerus.

The humeral artery then passes towards the middle of the elbow-joint; and, about an inch below the joint, divides into its two great branches, the *radial* and *ulnar arteries* *.

The ULNAR ARTERY passes behind the pronator teres, the flexor muscles of the hand, and then between the flexor sublimis and profundus digitorum.

It sends upwards a considerable branch, called *recurrens ulnaris*, which is placed under the flexor muscles, and supplies the anterior and inner side of the elbow-joint, and anastomoses above the internal condyle with the smaller branches of the arteria profunda humeri.

The artery then passes along the ulna, giving off several small branches to the fore-arm.

The next branch has been called the *interossea posterior*, as it perforates the upper part of the interosseous ligament. From this artery, there is

* The palm of the hand is supposed, in the following description of the arteries, to be in front.

also a recurrent branch, which anastomoses with the branches of the humeral artery.

The posterior interosseous artery is continued downwards to the back-part of the fore-arm, and its smaller branches supply the extensor muscles of the fingers.

The *interossea anterior* is sent off below the posterior, and is considerably larger than it.

This artery passes downwards along the fore-part of the interosseous ligament, and supplies the flexor digitorum profundus with blood.

A little above the wrist, this artery perforates the interosseous ligament, and divides into branches, which anastomose with the smaller ramifications of the posterior interosseous artery.

The ulnar artery then sends off many small branches, which supply the wrist; and passing over the annular ligament, forms the superficial palmar arch, from which the following branches are sent off: *three digital branches* which run in the interstices of the metacarpal bones to the roots of the fingers, each is subdivided into two branches; one of these runs along the radial margin, and the other along the ulnar margin of the finger: all the fingers are therefore supplied from this source, excepting the outer margin of the little finger, and the outer margin of the fore-finger.

Towards the points of the fingers, the arteries of opposite sides freely communicate with each other, and form an intricate plexus of vessels.

The ulnar artery also sends a branch, named *ulnaris profunda*, which anastomoses with the deeper-seated arterial arch, formed by the radial artery.

From the superficial arch, an artery is also sent to the thumb.

At the roots of the fingers, there is generally a communication between the superficial and deep-seated arterial arches.

The RADIAL ARTERY passes over the pronator teres, and then along the fore-part of the radius between the supinator radii longus, and flexor carpi radialis. This artery, in its course downwards, becomes more superficial, and at the wrist lies close on the radius. It sends off a *recurrent branch*, which passes between the tendon of the biceps, and supinator radii longus, and anastomoses at the outer part of the elbow-joint with the profunda humeri.

There are many *small branches* sent from this artery in its course downwards along the radius, to supply the neighbouring muscles.

From the branch of the radial, called *superficialis volæ*, another proceeds along the outer side of the thumb, which passes over the abductor pollicis, and anastomoses with the ulnar arch. The size of this branch is various in different individuals.

There are also *small branches* of the radial artery distributed upon the ligaments and bones of

the wrist, and to the back-part of the metacarpus and fingers.

At the carpal end of the radius, the radial artery turns back on the fore-part of the tendons of the extensor muscles of the thumb, and afterwards passes through the abductor indicis; after which it divides into the following branches: the *arteria magna pollicis*, which passes along the side of the thumb next the fingers; the *radialis indicis*, which passes along the side of the fore-finger next the thumb; the *palmaris profunda*, which, passing across the hand between the roots of the metacarpal bones and flexors of the fingers, assists in forming the deep-seated arterial arch of the palm of the hand *.

SECT. II.

OF VARIETIES AS TO THE DISTRIBUTION OF THE SUBCLAVIAN ARTERY.

THE varieties which occur as to the distribution of the subclavian artery, and as to the origin of its several branches, in an especial manner merit attention.

In some cases, as in that represented by Pl. XLIII., four large arteries take their origin from the arch of the aorta.

* SCARPA's 5th and 6th Plates affixed to his book, Sull Aneurisma, give very correct views of the anastomoses of the arteries of the neck, and of the shoulder and elbow-joints.

There is much variety as to the size and course of the inferior thyroid artery.

I have seen in Dr RAMSAY's Museum, a specimen, in which this artery ascended in front of the windpipe.

The vertebral artery in some cases takes its rise from the arch of the aorta; and in some very rare instances, enters the hole in the transverse processes of the third cervical vertebra, instead of that of the sixth or seventh cervical vertebra.

The thoracic arteries are very seldom derived from the same part of the axillary artery in different persons.

The subscapulary artery sometimes arises from the thyroid artery, and it varies also much in size. In those cases, where the transverse artery of the neck is of unusual size, this artery is generally smaller than usual.

There are many irregularities observed as to the distribution of the humeral artery and its branches; and it may not be improper to add, that I have seen many examples of such unusual distribution of arteries in both arms of the same subject.

In some instances, the humeral artery divides, in the axilla, into the radial and ulnar arteries; in other cases, in the middle of the os humeri; and the radial artery more frequently is sent off higher than the ulnar.

In some very rare cases, the ulnar artery runs immediately beneath the skin, and above the tendinous aponeurosis of the arm. My late pupil, Dr Ryan, who devoted great attention to the distribution of the arteries, and who was very expert in tracing their branches, has published the following accurate account of the irregularities of the Humeral Artery, which he saw in preparations in my possession: "Nuper in quinque exemplis quæ in musæo Doctoris Monro aspexi, (aliisque multis antea,) vidi radialem in axillâ emissam. Post talem originem ejus distributio maxime incerta est; tamen in paucis exemplis ejus cursus descriptionem tradere conabor. In uno casu arteria iter fecit ac eâdem brachialis vaginâ inclusa ad mediam brachii partem, dein hanc arteriam trajecit, ut musculum bicipitem subiret, et cursum continuavit prope ejus marginem exteriorem ad cubiti flexuram, unde more solito processit. In alio ex ejus origine in axillâ provenit, et ante brachialem ivit sub fasciâ quam proxime sita ad cubicum, ubi ramo transverso communicationem satis magnam cum ulnari formavit. Ex hac communicatione verâ exiit ramus longus sub fasciâ ad manûs palmam, ubi arcum palmarem intravit. Post emissionem hujus rami radialis cursum solitum secuta est. Forsan aliquid prosit notare, quod, quamvis arteria humeralis modo solito se dividat, arteria fere eâdem ac radialis magnitudine ex eâ interdum provenit in axillâ, ad marginem bicipitis iter facit, et ramo transverso cum

radiali communicat. Fœminam vidi in quâ hæc arteria fasciam pertransiît, mediâ in parte inter cubitum et carpum supra radium inclinavit ad ejus dorsum, et sic ad divisionem inter indicatorem et pollicem progressa est, et nullo in loco solita pulsatio percipi potuit. Observare liceat radialem ex humerali provenire in variis locis axillam inter et cubiti flexuram. Notandum quoque est, radialem, ulnarem, et interosseam, sæpe ex humerali emitti in parte brachii superiori *."

In a few cases, the humeral artery divides into two branches, and these are again united into one trunk †.

In a few cases, there is an additional artery ‡, which follows the same course as the humeral artery, and which is united with the radial branch of the humeral artery, which latter is sent off at the usual place.

There are varieties without number as to the origin, size, and disposition of the smaller branches of the humeral artery.

The profunda humeri sometimes is equal in size to the radial artery.

* Vid. Dissert. Inaug. de Quarundam Arteriarum in Corpore Humano Distributione. Edin. 1810.

† Vid. Plate xliv. fig. 3.

‡ Vid. Plate xliv. fig. 1. & 2.

The interosseous artery sometimes arises from the middle of the humeral artery.

The knowledge of these variations in the distribution of the bloodvessels of the arm is of the utmost importance to the Surgeon in various operations.

Explanation of Plate XLIV.

The three figures of this Plate, represent irregularities as to the distribution of the branches of the Humeral artery, and the two first are half the size of nature.

Fig. I.

1. Trunk of the humeral artery.

2. Branches of this artery distributed upon the pectoral muscle.

3. A descending branch.

4. Branches distributed upon the inferior scapulary muscles.

5. Small branches distributed upon the upper part of the biceps.

6, 7. Arteria dorsalis scapulæ inferior.

8. Continuation of the humeral artery, from which an additional branch runs down, as marked in No. 9, and joins the radial artery at No. 10.

11. The trunk of the humeral artery in its usual situation.

12. Internal articular branches of the humeral.

13. The ulnar artery.

14. The ulnar artery at the wrist.

15, 16. The superficial palmar arch formed by the Ulnar artery.

17. A branch of the ulnar going to the thumb.

18. The origin of the radial artery.

19. The continuation of this artery a little above the wrist.

20. A branch of the radial artery going to the first joint of the thumb.

21. & 22. Branches of the radial artery going to the fore finger.

Fig. 2.

This figure, which is half the size of nature, also represents an unusual distribution of the branches of the Humeral Artery, and such as has not been described by any preceding Author with whose works I am acquainted.

1. The trunk of the humeral artery.

2. A branch going to supply the teres major and minor.

3. A supernumerary artery, which was superficial, and placed between the skin and the tendinous aponeurosis of the arm.

4. The continuation of that artery at the elbow-joint.

5. The artery continued over the wrist.

6. The junction of that artery with the superficial arch in the palm of the hand, formed by the ulnar artery.

7. The trunk of the humeral artery continued down the arm in its usual situation.

8. The spiral branches of the humeral artery.

9. The articular branches of the humeral anastomosing with the branches of the spiral.

10. The humeral artery, before its division into ulnar, radial andnter osseous arteries.

11. Continuation of the trunk of the ulnar artery.

12. The ulnar artery near the wrist.

13, 14, & 15. are the branches of the artery forming the superficial palmar arch.

16. The trunk of the radial artery.

17. & 18. The continuation of the radial artery.

19. The interosseous artery.

Fig. 3.

1. & 2. Represent the humeral artery, which in the middle of the humerus divides into the radial and ulnar arteries.

3, 4, 5. & 6. Represent the course of the radial artery.

7, 8, 9, 10, 11, 12, 13. & 14. Point out the course of the ulnar artery.

It was very remarkable, in the preparation, that, below the elbow, the radial and ulnar arteries were joined by a cross canal.

SECT. III.

OF THE VEINS OF THE SUPERIOR EXTREMITIES.

THERE are two sets of veins, proper to the superior extremities, a superficial and deeper-seated set; both of which communicate frequently with each other, and both are provided with valves.

There is great variety as to the distribution of the veins in different individuals.

The *superficial veins of the back of the hand* go chiefly to the superficial, radial, and ulnar veins.

The *superficial radial veins* on the anterior part of the fore-arm communicate with the radial and ulnar veins, and with a trunk, called the *mediana longa.*

The *mediana longa* crosses over the radius, and divides below the elbow into the *mediana cephalica* and *basilica;* the former terminates in the cephalic above the elbow, and the latter crosses over the humeral artery, and ends in the basilic vein, which joins with the humeral vein.

The *cephalic vein* runs up the arm on the outer side of the biceps muscle; and, passing between the pectoralis major and deltoid muscles, terminates in the axillary vein.

The deeper-seated veins, named VENÆ COMITES SATELLITES, follow the same course as the ar-

eries; they join the more superficial, and form the Axillary Vein, which being joined with the thoracic veins, forms the SUBCLAVIAN VEIN: this passes between the clavicle and first rib; receives the cervical veins, and those corresponding with the dorsal scapulary artery; then spreads on the fore-part of the anterior scalenus muscle.

The subclavian vein then joins with the vertebral, internal jugular, and external jugular veins, internal mammary veins, and left intercostal veins.

The subclavian vein of the left side then crosses the three great arteries which arise from the arch of the aorta; and, opposite to the cartilages of the first ribs, unites with the corresponding subclavian vein, which together form the VENA CAVA SUPERIOR.

The VERTEBRAL VEIN communicates with the inferior petrosal sinuses, or with the occipital sinuses, and with the veins of the deeper-seated muscles of the neck.

SECT. IV.

OF THE NERVES OF THE NECK AND SUPERIOR EXTREMITY.

THE *Sub-occipital Nerves* have been described by some authors, as the first cervical nerve.

The Sub-occipital Nerves take their rise from the beginning of the spinal marrow by an anterior and posterior fasciculus.

These nerves, after their exit from the spinal canal, are connected with the ninth pair, and with the first cervical nerve; and their branches are distributed upon the recti and oblique muscles of the head.

The First Cervical Nerve passes out between the first and second vertebra of the neck, and divides into two large branches. *The one* furnishes nerves to the extensor muscles of the head and neck, and then ascends upon the occiput, dividing into many branches, which are distributed upon the back-part of the head. *The other branch* is united with the accessory nerve, the ninth pair of nerves, and uppermost ganglion of the sympathetic nerve, from which a nerve is sent downwards to the second cervical ganglion.

The Second Cervical Nerve, after passing between the vertebræ, is united to the middle ganglion of the sympathetic nerve, and also to the third cervical nerve.

This pair of nerves also sends *branches* to the sterno-mastoid muscle; a *branch*, which passes downwards along the jugular vein; a third branch, which assists in forming the phrenic nerve; a fourth branch, which divides into many branches, viz. the *inferior cutaneous nerve*, which supplies the parts of the lower jaw; the *middle cutaneous nerve*,

which supplies the parts around the angle of the jaw; and *a branch*, which supplies the back-part of the ear, called *posterior auricular*, and which subdivides into branches, which are distributed on the back-part of the ear and temple; the platysma muscle; the parotid gland, and which communicate with the portio dura of the seventh pair.

The continuation of the second cervical nerve is spent upon the extensor muscles of the head and neck, and the levator scapulæ.

The THIRD CERVICAL NERVE joins with the middle ganglion of the sympathetic nerve, with the trunk of the fourth cervical nerve, and assists in forming the *phrenic nerve*.

A branch of this nerve joins with the middle ganglion of the sympathetic nerve.

This nerve afterwards divides into *external* and *internal branches*; the former supplies the upper part of the scapula, the latter supplies the muscles and skin at the upper part of the neck and shoulder.

The FOURTH CERVICAL sends branches to the middle ganglion of the sympathetic nerve; to the deep muscles of the neck; glands of the neck; and it is connected to the phrenic nerve, and to the fifth cervical nerve.

The FIFTH CERVICAL NERVE is joined to the fourth and to the sixth cervical.

The SIXTH CERVICAL is considerably larger than the preceding, and joins the SEVENTH CERVICAL Nerves behind the clavicle.

The three inferior cervical and first dorsal nerves pass between the scalenus anticus and medius muscle, and under the subclavian muscle, to the axilla, where they form the *axillary plexus of nerves.*

In the axillary plexus of nerves, there is a very intimate intermixture of nervous threads *, which surrounds the axillary artery and vein.

The following nerves are derived from the axillary plexus.

1st, A NUMBER OF SMALL NERVES to the subscapulary, teres major, and latissimus dorsi muscles.

2d, The EXTERNAL THORACIC NERVES, which accompany the external thoracic arteries to the pectoral muscles, mammæ, and skin over these.

* Vid. representations of the axillary nerves in my Father's Book on the Nervous System. Tab. xv. & xvi.

" Every nerve," says my Father, " of the spinal marrow is joined near to its exit by an arch, with the nerve above and below it; but the connection of the several nerves of the arm, or of the leg, may be considered as chief examples of plexus."

" Many years ago, I was at the pains of tracing the fibres of the nerves of the arm, from their origin in the spinal marrow to their termination in the parts of the arm, by slitting open the sheaths of all the trunks where they form the brachial plexus. I found, indeed, as I expected, that in the plexuses the fibres of the different trunks were intermixed, and that every nerve under the plexus consisted of fibres of all the nerves, which were tied together above its origin from the plexus."

3d, The SCAPULARY NERVES, which pass to the muscles situated on the dorsum scapulæ through the superior scapulary notch, in the upper costa of the scapula.

4th, The ARTICULAR NERVES, which sink deep in the axilla, pass along the under edge of the subscapularis, and accompany the posterior circumflex artery around the os humeri.

From this plexus, small nerves are distributed upon the teres major and the deltoid muscles, and also on the capsular ligament of the shoulder-joint.

5th, The RADIAL OR MEDIAN NERVE. This nerve is placed before the trunk of the humeral artery, to which it is intimately united by cellular substance.

At the elbow-joint, it passes over the tendon of the brachialis internus; and having perforated the back-part of the pronator teres, descends between the flexor carpi radialis and flexor sublimis; to which muscle it sends off small branches.

From the radial nerve, a large branch called *interosseous*, is derived, as it passes along the interosseous ligament.

The interosseous nerve, in its course to the wrist, supplies the flexor muscles of the thumb and fingers, and terminates on the pronator radii quadratus.

The trunk of the radial nerve passes under the annular ligament of the wrist to the palm of the

hand, where it is covered by a thick tendinous aponeurosis; and in that situation, divides into seven branches; two of which lead to the thumb, one to the side of the fore-finger next the thumb. The other branches are derived from two trunks, and supply the opposite side of the fore-finger, both sides of the middle finger, and the side of the ring-finger next the middle finger.

There are several smaller nerves also sent from the radial nerve, which are distributed upon the lumbricales muscles; and there are others which accompany the branches which form the superficial palmar arch.

The nerves of the opposite sides of the fingers are united at their points, and at length terminate by a great many small nerves.

6th, Ulnar Nerve. This large nerve passes along the triceps muscle; and at the elbow, occupies the groove between the inner condyle of the os humeri and olecranon ulnæ.

The nerve then passes through the heads of the flexor muscles, and follows the same course as the ulnar artery along the fore-arm.

Near to the lower end of the ulna, there are *two or three small branches* sent off, which pass to the back of the hand, between the ulna and the flexor carpi ulnaris; from which there are various small nerves, which supply the wrist, and which join with the branches of the spiral nerve.

There is another *considerable branch* sent off from the nerve before it passes into the palm of the hand, which runs along the ulnar side of the little finger, and is subdivided into two branches; one of which runs on the side of the little finger next the ring-finger, and the other on the side of the ring-finger next the little finger.

The trunk of the ulnar nerve passes over the annular ligament of the wrist along with the ulnar artery; and having reached the palm of the hand, is subdivided into *superficial* and *deep-seated branches;* the former of which is distributed upon the muscles of the little finger, and the opposite sides of the little finger.

The *deeper-seated branches* of the ulnar nerve in the palm of the hand, pass between the abductor and flexor parvus minimi digiti, and then form an arch, which accompanies the branches of the radial artery; and from this deep-seated arch, there *are branches derived*, which supply the abductor minimi digiti, the flexor brevis, abductor pollicis, lumbricales, and interossei muscles.

From the branches of the nerves which supply the fingers, there are many *lateral branches*, which are distributed upon the muscles of the fingers, and which at last terminate upon the points of the fingers, by a number of small fibrils.

There are many anastomoses between the smaller branches of the radial and ulnar nerves.

It may not be improper to add, that, under the axilla, the ulnar and spiral nerves are united by small branches, from which union, a small branch is sent, which passes under the skin which covers the triceps muscle *.

7th, The SPIRAL NERVE, the largest nerve derived from the axillary plexus, is placed between the ulnar nerve and axillary artery; it passes downwards obliquely between two of the heads of the triceps, and afterwards to the outer side of the arm.

In its course along the posterior part of the os humeri, there are several branches detached from it to the triceps muscle, and one accompanies the spiral artery, and is spent upon the extensor muscles of the fore-arm.

There is also a subcutaneous branch sent off behind the os humeri, which passes down to the back-part of the fore-arm, and back-part of the hand, and joins with the branches of the ulnar nerve.

The trunk of the nerve at the elbow-joint, is imbedded in the groove between the extensores carpi radiales, and brachialis internus; and when so situated, detaches several small branches to the extensor and flexor muscles.

Opposite to the head of the radius, the trunk of the nerve is subdivided into *two great branches,*

* Vid. CAMPER's Views of the Nerves of the Arm.

one of which, is *deep-seated*, the other *more superficial.*

The *superficial branch* descends along with the radial artery, and below the middle of the radius, is subdivided into the *volar* and *dorsal* branches.

The former is distributed upon the annular ligament and muscles of the thumb; the latter divides into a number of small branches, which are distributed upon the muscles in the vicinity of the metacarpal bones and fore-finger; and there are also *branches* of this nerve which are proper to the fore and middle fingers, and to the side of the ring-finger next to the middle-finger.

The *deep-seated branch* supplies the extensores carpi radiales, perforates the supinator radii, and reaches the back-part of the fore-arm, and, descending along the extensor primi internodii pollicis, arrives at the back-part of the hand, and annular ligament of the wrist, and at length terminates on the back-part of the metacarpus.

8th, The Musculo-Cutaneus, or Perforans Casserii. The trunk of this nerve perforates the upper-part of the coraco-brachialis muscle, and afterwards passing between the scapulo-radialis, and brachialis internus muscles, to both of which, it gives many small branches; gets to the outer side of the tendon of the scapulo-radialis muscle, and passes behind the median cephalic vein; afterwards it passes down the arm under the skin, and over the supinator radii longus, as far as the

root of the thumb, and gives also branches to the back of the hand.

9th, The Nervus Cutaneus so named, from its situation under the skin, passes down along the inner and fore part of the arm. In its course downwards, it supplies the biceps muscle and coraco-brachialis muscle; and at the elbow-joint, or a little higher, is divided *into two branches*, which have been named, from their situation on the outer and inner sides of the arm, *external* and *internal*.

The *external* passes behind; and its branches pass before the median basilic vein, (Vid. Plate xlv.,) and afterwards suddenly divides into a number of very small nerves, which are spent upon the elbow-joint and fore-arm.

The *internal* branch, which is rather smaller than the preceding, crosses over the basilic vein to the inner side of the elbow, and terminates on the inner side of the fore-arm. Vid. Plate xlv, and xlvi.

10th, The Cutaneus Internus of Wrisberg. The Cutaneus Internus of Wrisberg also takes its rise from the axillary plexus.

This nerve, which is smaller than the former, divides into two branches: the larger descends along the triceps, and disappears at the under part of that muscle; the former winds round to the back-part of the arm, and is spent upon the triceps.

The nerves, called the INTERCOSTO-HUMERALES, derived from the second and third intercostal nerves, are distributed upon the superior extremity, and chiefly upon the axillary glands, and parts in their vicinity on the inner side of the arm.

Explanation of Plate XLV.

In this Plate, the usual distribution of the veins at the elbow-joint is represented, as also the neighbouring subcutaneous nerves.

A The biceps flexor cubiti.
B The tendon of the biceps muscle.
C The internal condyle of the os humeri.
F The dotted lines mark the course of the humeral artery.
H The cephalic vein.
I The basilic vein.
K The vena mediana longa.
L The mediana cephalica.
M The mediana basilica.
PP The external branches of the cutaneous nerve.
TSU The internal branches of the cutaneous nerve.

Explanation of Plate XLVI.

In this Plate, an unusual distribution of the veins at the elbow-joint, is represented.

B The biceps flexor cubiti.
C The internal condyle of the os humeri.

F & G Point out the humeral artery.
H The cephalic vein.
K The vena mediana longa.
II The ulnar veins.
P A second mediana longa.
L The mediana cephalica.
M The mediana basilica.
OO The external branches of the cutaneous nerve.
N The internal branches of the cutaneous nerve, passing behind.
M The vena mediana basilica.
X The deep-seated humeral vein.
Z The radial nerve.

SECT. V.

OF THE LYMPHATIC VESSELS OF THE SUPERIOR EXTREMITIES.

THERE are two sets of lymphatic vessels, which are proper to the superior extremities; a *superficial* and *deeper-seated set.*

The *superficial* lymphatic vessels, are found on the fore and back parts of the fingers and hands.

Those on the fore-part of the arm run upwards, directly on the fore-part of the arm; those on the back-part of the fore-arm, are directed obliquely upwards, and towards the inner-side of the elbow-joint.

The lymphatic vessels continue their course upwards, along with the basilic vein, and some of these pass into small glands in the vicinity of the

humeral artery; but the greater number of these vessels do not enter into any gland until they reach the glands of the axilla.

There are also a few lymphatic vessels which accompany the cephalic vein, and passing between the pectoral and deltoid muscles, are connected with some lymphatic glands, which are found at the under-part of the clavicle.

The *deeper-seated* lymphatic vessels, which accompany the branches of the arteries, accompany the radial, ulnar, and humeral arteries, and at length join the axillary lymphatic glands.

The greater number of the lymphatic vessels of the mammæ and lateral parts of the chest, join with the axillary glands; and there are various branches which pass over the clavicles, and terminate in lymphatic glands at the bottom of the neck.

From the axillary glands, large lymphatic vessels pass beneath the subclavian muscle, and by their union form a trunk, which, on the left side of the body, leads to the thoracic duct near to its termination in the angle formed by the internal jugular and subclavian veins.

On the right side of the body, the trunk formed by the lymphatic vessels of the superior extremity, joins with the large lymphatic trunk, called the Trunk of Steno.

CHAPTER III.

OF THE BLOODVESSELS, NERVES, AND LYMPHATIC VESSELS OF THE THORAX.

SECT. I.

OF THE THORACIC AORTA.

THE aorta descends on the left side of the vertebræ of the back; and from it, several branches are derived, before it reaches the abdomen, besides those which have been already described.

The arteries called BRONCHIAL, as they are distributed upon the bronchi or lungs, take their rise from the upper part of the descending aorta.

The number and size of the bronchial arteries, are various in different subjects.

These bronchial arteries have been divided into two classes, the Right and Left.

The *right bronchial arteries*, are distributed upon the right lungs, the bronchial lymphatic

glands, and the inner membranes of the larger branches of the windpipe.

The *left bronchial arteries*, which are unequal in size, take their rise from the fore-part of the aorta; they are subdivided into many small branches, which are distributed through the substance of the lungs, along the coats of the pulmonary arteries and veins, and anastomose with the smaller ramifications of the pulmonary artery.

The ARTERIÆ OESOPHAGEÆ take their rise from the aorta, or from the bronchial arteries; they are subdivided into very minute branches, which are spent upon the coats of the gullet, and form an intricate plexus upon the innermost coat of that organ.

There are also branches of these arteries distributed upon the posterior mediastinum and pericardium.

The SUPERIOR INTERCOSTAL ARTERY is also a branch of the thoracic aorta. There are three large branches of this artery, which are lodged within the grooves of the ribs; and the smaller branches of these arteries pass backwards to the spine, spinal marrow, and muscles of the back.

The INFERIOR, OR AORTIC INTERCOSTAL ARTERIES, which are eight or ten pairs, take their rise from the back and lateral parts of the aorta, and are situated in the grooves in the under edges of the ribs between the intercostal muscles.

The four uppermost are the smallest, and ascend. The intercostal arteries send small branches to the spine and spinal marrow, and intercostal muscles; and many branches pass between the ribs, and after supplying the muscles of the chest, anastomose with the external mammary arteries.

The Superior and Posterior Pericardiac Arteries, are also derived from the descending aorta, but sometimes from the subclavian and internal mammary.

These arteries are distributed upon the pericardium, lungs, and gullet.

The superior branches of the inferior intercostals, anastomose with the superior intercostal arteries; while the inferior branches of the inferior intercostal arteries, anastomose with the epigastric and lumbar arteries.

Sect. II.

There is much variety as to the origin of the bronchial and intercostal arteries, but which does not lead to any derangement in the functions of the organs upon which they are distributed.

SECT. III.

OF THE VEINS WHICH CORRESPOND WITH THE BRANCHES OF THE AORTA AND SUBCLAVIAN ARTERIES WHICH ARE PROPER TO THE THORAX.

THE intercostal veins correspond in size and situation with the intercostal arteries.

The lower aortic left intercostal veins unite, and form the beginning of the VENA AZYGOS, which crosses the aorta, runs upwards along the spine, and receives during its ascent the intercostal veins of the right side of the chest, as also the bronchial veins, and then joins the VENA CAVA SUPERIOR.

There is also a venous trunk on the left side of the body, called LEFT VENA AZYGOS, which is formed by the superior intercostal veins, and bronchial veins of the left side, and veins of the gullet.

The left, or smaller vena azygos, terminates in the subclavian vein of the left side.

SECT. IV.

OF THE NERVES WHICH CORRESPOND WITH THE ABOVE BLOODVESSELS.

THE nerves which correspond with the bloodvessels described in the preceding section, are, the *phrenic*, or *diaphragmatic nerves*, the *pars vaga of the eighth pair*, the *sympathetic*, and the *intercostal nerves*.

Of the Phrenic Nerve.

The Phrenic Nerve, formed by the second, third, and fourth cervical nerves, descends along the forepart of the scalenus anticus muscle, enters the chest between the subclavian artery and vein, passes along the pericardium, and having reached the diaphragm, is subdivided into several small branches, which are distributed to different parts of the muscular substance of the diaphragm.

Of the Par Vagum of the Eighth Pair of Nerves.

Upon the recurrent nerve being detached from the eighth pair of nerves, there is *a plexus of nerves*

formed by the small branches passing from the recurrent nerves of opposite sides, and by the branches of the sympathetic nerves, which go to the heart. This plexus covers the larger branches of the pulmonary artery; and there are some small branches of nerves which creep along the smaller ramifications of the pulmonary artery.

This plexus, has been called the *anterior pulmonary plexus of nerves*, in contradistinction to the *posterior pulmonary plexus*, formed by the eighth pair, and which are situated behind the root of the lungs.

The pulmonary plexuses being detached, the eighth pair divides into chords, which surround the oesophagus, and which form what anatomists have described as the *œsophagean plexuses.*

Of the Sympathetic Nerve.

The branches from the sympathetic nerve, creep along the surface of the arteries and veins connected with the heart.

Of the Cardiac Nerves of the Right Side.

On the right side, there are two principal nerves, *the great* and *smaller cardiac nerves*. The trunk of

the former passes between the superior cava and ascending aorta, to the posterior part of the aorta, where the cardiac nerves of the left side are added: thus, the *plexus cardiacus magnus* of HALLER is formed.

From this plexus, a branch is sent to the *left coronary* plexus, branches which creep along the right branch of the pulmonary artery to the heart, and a branch to the anterior coronary plexus.

The *lesser cardiac nerve*, passes along the arteria innominata and aorta, and ends in a plexus formed by the cardiac nerves on the left side of the aorta ascendens.

Of the Cardiac Nerves of the Left Side.

The left cardiac nerves are *superficial* or *deep-seated.*

The superficial passes behind the arch of the aorta, to the *great cardiac plexus.*

The deeper-seated cardiac nerve, passes across the arch of the aorta; joins the *cardiac nerves* of the eighth pair, and forms the *cardiac plexus;* and from this plexus, a nervous web extends on the left side of the ascending aorta, from which the *right coronary plexus* is derived, which passes between the pulmonary artery and aorta, and then along the coronary vessels.

From the great cardiac plexus of the left side, a *nervous plexus* extends *on the left coronary artery;* and from this, small nerves creep along the surface of the left coronary arteries, to the point of the heart *.

The cardiac nerves being sent off, the sympathetic nerves unite into a trunk behind the subclavian artery, and descend along the heads, and over the heads of the ribs, and a ganglion is formed by their junction with the intercostal nerves †.

From the sixth, seventh, and eighth dorsal ganglia, branches arise, which form the nerve called by HALLER *nervus splanchnicus*, which passes through the appendix of the diaphragm, and supplies the bowels of the abdomen.

Of the Intercostal, or *Dorsal Nerves.*

These nerves, after being sent off from the spinal marrow, are lodged in the grooves in the lower edges of the ribs, and advance to the forepart of the chest between the intercostal muscles.

There are branches of these nerves which supply the muscles in the vicinity of the spine, the intercostal muscles, and also those of the abdomen.

* Vid. SCARPA's Third Plate of the Nerves of the Neck.

† Vid. MONRO's Nervous System, Plate xi.

The *upper intercostal nerves*, give off branches which supply the muscles on the upper and outer part of the chest, and also branches which pass along the branches of the internal mammary artery to the mammæ.

The *lower intercostal nerves*, supply the muscles of the thorax and of the abdomen.

SECT. V.

OF THE LYMPHATIC VESSELS WHICH ARE PROPER TO THE HEART AND LUNGS.

Of the Thoracic Duct.

THIS duct is formed by the lymphatic vessels of the inferior extremities, and by the trunk formed by the lacteal vessels.

These trunks unite, and form the receptacle of the chyle, an oval-shaped bag, which is placed upon the second lumbar vertebra.

The thoracic duct passes upwards, close to the spine; at first behind the aorta; it then perforates the diaphragm behind its right crus; reaches the thorax, and is placed between the aorta and vena azygos; and at last terminates at the junction of the internal jugular and subclavian veins of the left side of the body.

The thoracic duct is of unequal diameter: the receptacle of the chyle, the origin of the duct, is about one-third of an inch in diameter; it is much contracted about the middle of the chest, and then becomes gradually larger as it ascends.

There are many lymphatic vessels joined to the thoracic duct during its ascent along the spine, from the bowels of the abdomen, the intercostal spaces, and from the lungs.

Of the Lymphatic Vessels of the Lungs.

There are two sets of lymphatic vessels proper to the lungs, a superficial and deeper-seated set. The former describe areolæ between the lobules of the lungs, and pass into the bronchial glands; where these are joined by the deeper-seated lymphatic vessels, which accompany the branches of the trachea and pulmonary artery.

There are some of the absorbent vessels of the left lungs which pass through glands behind the arch of the aorta.

The lymphatic vessels which have passed through the bronchial glands, form trunks which ascend on the fore-part of the vena cava superior, and terminate in Steno's duct on the right side of the neck.

Of the Lymphatic Vessels of the Heart.

The lymphatic vessels of the heart accompany the coronary arteries; those of the right side pass over the arch of the aorta, to a lymphatic gland situated behind the origin of the carotid arteries, and terminate on the right side.

The lymphatic vessels which accompany the left coronary artery, pass into a gland situated behind the pulmonary artery, between the arch of the aorta, and root of the trachea. These terminate on the upper end of the thoracic duct *.

* The lymphatic vessels of the heart, are much smaller than those of the lungs; they have been very beautifully represented by MASCAGNI in his 26th Plate.

CHAPTER IV.

OF THE BLOODVESSELS, NERVES, AND LYMPHATIC VESSELS WITHIN THE CAVITY OF THE ABDOMEN.

SECT. I.

OF THE BRANCHES OF THE AORTA SENT OFF WITHIN THE ABDOMEN, OR OF THE ABDOMINAL AORTA.

By Abdominal Aorta, is understood, that portion of the aorta, which intervenes between the diaphragm, and the division of the aorta, into its two great branches, called the *iliacæ communes*.

The aorta passes between the tendinous columns of the smaller muscle of the diaphragm, and hence the flow of blood through it cannot be affected by the movements of the diaphragm.

The *Abdominal Aorta* is situated on the left side of the bodies of the vertebræ; and approaches gradually to the middle of the vertebræ.

The *First Branches of the Abdominal Aorta* are distributed upon the diaphragm. These are two in number; they cross over the crura of the diaphragm; are distributed on every part of this muscle; and a few of the smaller branches supply the renal capsule, fat of the kidney, and cardia.

The next branch is large, and short, called *cœliac*, which subdivides immediately into three branches; the SUPERIOR GASTRIC, HEPATIC, and SPLENIC arteries. The trunk of the cœliac is surrounded by the lesser curvature of the stomach.

The SUPERIOR GASTRIC is the smallest of the branches; it ascends, is distributed chiefly on the right side of the cardia; and its branches anastomose with the arteries of the gullet; it passes upon the smaller curvature of the stomach; and its branches are distributed in all directions, and anastomose freely with the ramifications of the hepatic and splenic arteries.

The next branch of the cœliac, is the SPLENIC, which runs transversely across the body behind, and then on the upper-part of the pancreas, to which it gives several branches, and divides into five or six branches in the notch of the spleen, which carry blood to every part of that organ.

A large artery is derived from this trunk, called the GASTRICA INFERIOR SINISTRA, which passes along the greater curvature of the stomach, and communicates with the gastrica dextra.

From this artery, the pancreas, omentum and mesocolon receive several small branches. There are *four or five branches* of the splenic artery, called *vasa brevia*, which are spent on the great left sac of the stomach, and anastomose with the branches of the left superior and left inferior gastric arteries.

The HEPATIC BRANCH, or RIGHT BRANCH of the COELIAC ARTERY, is concealed by the pancreas; it passes forwards and upwards behind the pylorus; and, near to the neck of the gall-bladder, divides into the GASTRICA INFERIOR DEXTRA, and the proper HEPATIC ARTERY.

From the gastrica dextra, the following branches are derived:

The ARTERIA PYLORICA, which supplies the pylorus: The *duodenalis*, which is dispersed on the right portion of the duodenum: Small *branches* to the pancreas.

The trunk of the artery then passes along the great curvature of the stomach, and anastomoses with the arteria epiploica sinistra, a branch of the splenic artery.

The hepatic artery, during its progress along the great curvature of the stomach, is subdivided into the following branches:

Branches to the *omentum; branches* to the *stomach*, which anastomose with the superior gastric and pyloric arteries.

The Right Branch of the Hepatic Artery, before dipping into the substance of the liver, sends off branches to the gall-bladder, called the *Cystic*, which pass along the left side of the gall-bladder, and which are subdivided into a number of very minute branches upon the villous coat of the gall-bladder.

Of the Superior Mesenteric Artery.

The Superior Mesenteric Artery, which is equal in some to the cœliac artery, takes its rise from the aorta, about a quarter of an inch below the cœliac: it is concealed by the pancreas.

This artery passes over the duodenum, and is situated between the layers of the mesentery; it turns from the left side of the spine, towards the right, forming an arch. From the left or convex side of the arch, *twenty* or *thirty large branches* are sent; each of which divides into two branches, which communicate with each other, and form arches; from the convex part of which still smaller arteries are derived, which anastomose in a similar manner.

There is a similar junction and separation of the smaller branches: at length the branches are straight, which pass to the intestines, and which

upon the villous coat are subdivided into very minute branches, which terminate upon the villi.

There are *several small branches* of this artery sent to the pancreas, which afterwards supply the duodenum, and anastomose with the branches of the cœliac.

The larger branches of this artery on the left side convey blood to the *jejunum* and *ileum;* and these branches anastomose with each other by transverse arches.

The larger branches of this artery on the right side are placed between the layers of the mesocolon, and have been named,

1st, The Colica Media, or *Anastomotica*, which supplies the middle of the transverse arch of the colon; and the left branch of this artery communicates with the colica sinistra, and inferior mesenteric artery.

2d, The Colica Dextra; by means of which the right side of the colon is supplied with blood.

3d, *Small branches,* which are distributed on the omentum, and communicate with the arteriæ gastro-epiploicæ.

4th, The Ileo-Colic, which supplies that part of the ileum which terminates in the colon; and from which a branch is derived, which communicates with the colica dextra.

Of the Inferior Mesenteric Artery.

The INFERIOR MESENTERIC ARTERY, derived from the left side of the aorta, descends behind the peritoneum upon the psoas muscle, and soon divides into an ascending branch; and the *left colic artery*; the former of which supplies the colon with blood; and communicating with the Colica media, forms the mesocolic arch; the latter supplies the sigmoid flexure of the colon, called HÆMORRHOIDALIS INTERNA. The continuation of the trunk of the artery descends behind the back part of the intestinum curvum, which it supplies with blood, and communicates with the left colic artery.

SECT. II.

OF THE CORRESPONDING VEINS.

THE veins correspond in their situation with the arteries above described, except the hepatic.

The large trunks of the veins, viz. the MESENTERIC, the GASTRIC, and the SPLENIC, unite in forming a large venous trunk, which lies under the head of the pancreas, and then enters the liver at its Portæ; and hence has been called the VENA PORTARUM. The vena Portæ reaches the liver,

it receives the *venæ cysticæ*, and then divides into two great branches; one of which supplies the right lobe, and the other the left lobe of the liver.

The blood carried to the liver by the hepatic artery and venæ portæ is returned to the heart by veins, called VENÆ CAVÆ HEPATICÆ, which open into the vena cava by two, and often by three trunks, where the vena cava perforates the diaphragm.

SECT. III.

OF THE NERVES OF THE CHYLOPOETIC AND ASSISTANT CHYLOPOETIC VISCERA.

THE nerves of the chylopoetic, and assistant chylopoetic viscera, are derived from the *sympathetic nerve*; the *par vagum of the eighth pair of nerves*; and the *rami splanchnici*.

The RAMI SPLANCHNISI arise from the sympathetic nerves; they pass through the upper and lateral parts of the smaller diaphragm, and join the great semilunar ganglion.

The PARIA VAGA of the eighth pair also assist in forming the semilunar ganglion.

The par vagum of the left side having passed along the gullet, gets to the fore-part of the upper orifice of the stomach, and divides into a number of small nerves, which are distributed on the

upper surface of the stomach; and a few filaments from this nerve join the left hepatic plexus.

The PAR VAGUM of the right side, situated upon the back-part of the stomach, divides into two plexuses; one of which joins the hepatic plexus; the other is distributed upon the upper and great left sac of the stomach.

The SEMILUNAR SOLAR GANGLION *, formed by the paria vaga and the rami splanchnici, is of an irregular form; and from it, nerves are derived, which accompany the cœliac artery and its branches.

The COELIAC GANGLION covers the aorta, and the roots of the cœliac and superior mesenteric arteries; from which a nervous plexus is derived, which covers the trunks and branches of the cœliac and the superior mesenteric arteries.

From this ganglion, the hepatic plexuses are also derived.

From the right hepatic plexus, the right extremity of the pancreas is supplied; the pyloric portion of the stomach; the duodenum, and the greater curvature of the stomach.

The branches of the hepatic plexus also accompany the branches of the hepatic artery and vena portarum through the substance of the liver; and are also distributed upon the gall-bladder and biliary ducts.

* Vid. WALTERI Tab. Nerv.

The Splenic Plexus of nerves accompanies the splenic artery, and also the smaller branches of the splenic artery, into the substance of the spleen.

The Superior and Inferior Mesenteric *Plexuses of Nerves* form sheaths, which envelope the trunks and branches of the corresponding arteries.

From these sheaths, very small nerves are derived, which are distributed over the surface of the mesentery, and the mesenteric glands.

The nerves of the colon are proportionally larger than those of the smaller intestines, and are frequently united.

The inferior plexus of nerves is continued downwards along the left portion of the colon, and the intestinum curvum.

The aorta is included within a plexus of nerves, called the *Hypogastric.*

CHAPTER V.

OF THE ARTERIES, VEINS, LYMPHATIC VESSELS AND NERVES OF THE ORGANS OF URINE AND GENERATION.

SECT. I.

OF THE RENAL ARTERIES.

THE RENAL ARTERIES are sent off from the aorta, immediately under the superior, and above the inferior mesenteric artery, by a trunk on each side.

The renal artery of the right side is placed behind the vena cava, and is longer than the left.

Each renal artery at the concave part of the kidney is subdivided into three or four branches, which surround the pelvis of the kidney, and then plunge into the substance of these organs, and are spent chiefly on the cortical parts of the kidneys, and form arches at the roots of the papillæ of the kidney.

A *few small branches of the renal arteries* supply the fat around the kidneys with blood, and also the renal capsules.

The fat around the kidneys is also supplied with blood from the diaphragmatic arteries.

Of the Spermatic Arteries.

The SPERMATIC are the next arteries which take their rise from the fore-side of the aorta; they run towards the pelvis along the psoas muscles behind the peritoneum; the right passes over the vena cava, and the left behind the cholic arteries. The spermatic arteries join the spermatic veins on the psoas muscle. The spermatic arteries of the male then pass along the inguinal canal, through the upper and under abdominal apertures, and are at length dispersed upon the epididymis and body of the testicles.

The spermatic arteries also *send branches* in their course downwards to the ureters.

The spermatic arteries of the female divide into two branches: the posterior pass along the broad ligaments of the uterus to the ovaria; the anterior pass along the fallopian tubes to the uterus, and communicate freely and repeatedly with the uterine hypogastric arteries.

Of the Iliacæ Communes.

The aorta divides opposite to the third lumbar vertebra into two great branches called ILIACÆ COMMUNES.

The common iliac arteries pass downwards and outwards, and each divides over the sacro-iliac symphyses, into the ILIACA ANTERIOR, and ILIACA POSTERIOR.

Of the Branches of the Posterior Iliac Artery, proper to the Organs of Urine and Generation.

The branches of the posterior iliac are, the UMBILICAL, the VESICAL, the UTERINE, VAGINAL, and PUDIC.

The greater share of the umbilical is, in the adult, converted into a ligament. From the origin of the umbilical artery, a few branches take their rise, and are distributed on the bladder of urine, the vesiculæ seminales, prostate gland, and intestinum curvum.

The uterine arteries come off between the gluteal and pudendal arteries; pass along the sides of the uterus, towards its upper part, where they anastamose with the spermatic arteries.

These arteries send *small branches to the vagina.*

The vagina also receives blood from the pudic, and vesical arteries.

The Pudic Arteries are derived from the branches of the posterior iliac, called *hypogastric*, or from the ischiatic arteries.

These arteries pass through the under-part of the notch of the os ilium, and then between the sacro-ischiatic ligaments, to the inner sides of the tuberosities of the ischia, from which, in the male, they advance along the inner side of the ascending branch of that bone, behind the transversalis muscle and crus penis. In the above course, there are several branches derived from the trunk of the artery:

1st, The perineal artery, which ascends between the accelerator urinæ and erector muscles, supplying with blood the fat, muscles and skin of the perineum.

2d, The principal artery of the penis, which divides into two great branches; one of which runs along the dorsum penis, and another artery subdivides into the arteries proper to the corpora cavernosa penis, and which supply also the corpus spongiosum urethræ *.

* Dr Camper's Engravings of the Pelvis give very accurate representations of the course of the Pudic Artery.

SECT. II.

VARIETIES AS TO THE DISTRIBUTION OF THE ARTERIES PROPER TO THE ORGANS OF URINE AND GENERATION.

DEVIATIONS from the usual course of the above arteries seldom occur.

Instead of one large renal artery, I have seen two or three separate trunks running to the kidney.

The pudic artery sometimes is attached to the lateral and inferior part of the bladder of urine; and instead of passing outwards between the sacro-sciatic ligaments, according to Mr A. BURNS, "traverses the upper segment of the prostate gland." He has added: "In all instances of this lusus, which have come to my knowledge, the artery has run above that portion of the prostate gland which projects beyond the side of the urethra."

There is considerable variety as to the origin of the obturator artery. Sometimes it takes its rise by a short, and sometimes by a long trunk from the epigastric artery, as has been particularly described in the article upon Hernia in the Second Volume.

The branches of the arteria circumflexa ossis ilii sometimes ascend for a considerable way upon the muscles of the abdomen; and have, according to Mr BURNS, been opened in performing the paracentesis of the abdomen.

SECT. III.

OF THE LYMPHATIC VESSELS OF THE ORGANS OF URINE AND GENERATION.

THE *Lymphatic Vessels* of the penis are superficial or deep-seated: the former pass into the inguinal glands, and the deeper-seated lymphatics accompany the arteries to the deeper parts of the pelvis. The lymphatic vessels of the testicle arise from the substance of that organ, from the epididymis and coats of the testicle; they join with those of the spermatic chord, and pass through the inguinal canal, and terminate in the lumbar glands.

The lymphatic vessels of the external organs of generation of the female go to the inguinal glands, or to the iliac glands, and terminate in the lumbar glands; and in their course, frequently communicate with each other.

The lymphatic vessels of the inguinal glands pass upwards to small glands situated at the sides of the iliac arteries, and hence called *iliac glands*;

and from them the lymphatic vessels pass upwards to a cluster of glands, situated over the aorta, where it divides into its great branches, and which have been called *lumbar lymphatic glands*.

SECT. IV.

OF THE VEINS WHICH CORRESPOND WITH THE ARTERIES OF THE ORGANS OF URINE AND GENERATION.

THE RENAL VEINS terminate in the vena cava inferior; the left is longer than the right, as the aorta intervenes between the left kidney and the vena cava.

The veins which correspond with the arteriæ capsulares, terminate in the renal vein, and sometimes in the vena cava.

The SPERMATIC VEINS are larger than the spermatic artery, and form a plexus which accompanies the spermatic artery; and opposite to the lower end of the kidney, this plexus terminates in a single trunk, which ends in the vena cava, a little below the renal vein.

The termination of the spermatic vein of the female, is similar to that of the male.

There are veins which correspond with the arteries of the bladder of urine, which lead into the hypogastric veins.

The veins of the penis form a large vein, which runs along the penis, called the *vena ipsius penis*;

it passes backwards between the root of the penis, and arch of the pubis, forms a plexus of veins which surround the neck of the bladder and prostate gland.

The branches of the pudic artery, are accompanied by veins, which form a trunk, which lies in contact with the pudic artery.

The pudic vein communicates anteriorly with the vena ipsius penis, at the root of the penis.

SECT. V.

OF THE NERVES OF THE ORGANS OF URINE AND GENERATION.

A plexus of nerves is derived from the cœliac plexus, and from the great sympathetic nerve which envelope the renal arteries and their branches.

The spermatic nerves, which follow the same course as the spermatic artery, are derived from the renal and aortic plexuses, and form the second lumbar nerves.

The pudic nerves, which are branches of the sciatic nerves, follow the same course as the pudic arteries.

The principal nerve of the penis, is called the *dorsal nerve*; it is placed between the corresponding artery and vein, and running along the dorsum penis, terminates on the glans.

CHAPTER VI.

OF THE ARTERIES, VEINS, LYMPHATIC VESSELS, AND NERVES OF THE PARIETES OF THE ABDOMEN, PELVIS, AND INFERIOR EXTREMITIES.

SECT. I.

OF THE ARTERIES OF THE PARIETES OF THE ABDOMEN, PELVIS, AND OF THE INFERIOR EXTREMITY.

THE Lumbar Arteries, take their rise, in pairs, from the back-part of the aorta; the left are longer than the right, as they pass under the vena cava.

The lumbar arteries give branches to the spine, spinal marrow, muscles of the loins, the transverse and oblique muscles of the abdomen, and they communicate with the lower intercostal, diaphragmatic, and epigastric arteries.

Sacra Media.—This artery takes its rise from the bifurcation of the aorta; it descends along the middle of the os sacrum to the ossa coccygis, to which it gives branches, and communicates with the arteries, called *sacræ laterales.*

From this artery, there are a number of small branches derived, which are distributed upon the muscles of the loins, and upon the iliacus internus muscle.

Of the Iliacæ Communes.

The branches of the aorta called *iliacæ communes*, sweep along the sides of the pelvis, and nearly opposite to the sacro-iliac symphyses: and each divide into an Anterior and Posterior Iliac Artery.

Of the Iliaca Posterior.

The trunk of this artery, passes backwards and downwards for about a couple of inches; it then divides into an anterior and posterior set of branches.

Of the Posterior Branches of the Posterior Iliac Artery.

Ilio-Lumbar, or Iliaca Interna Minor.—This artery ascends between the psoas and iliacus

internus muscles, towards the crista of the os ilium; and anastomoses with the lumbar arteries, and circumflex of the os ilium.

Sacræ Laterales.—There are three or four of these arteries; they sometimes take their rise from the ilio-lumbar, or from the gluteal artery.

These arteries descend on the side of the os sacrum, communicate with the sacra media; and branches of this artery enter the foramina of the os sacrum, and supply the cauda equina.

The course of the vesical, hemorrhoidal, and pudendal arteries, which are branches of the iliaca posterior, has been already described.

Arteria Glutea.—The gluteal artery, is the largest branch of the posterior iliac; it takes its rise from the back-part of the trunk of the iliac, passes backwards through the upper part of the great notch of the os ilium, and is subdivided into two great branches, a *superficial*, and *deep-seated branch.*

The superficial passes between the gluteus maximus, and medius; to both of which, it gives many branches. This artery anastomoses with the sacral artery.

The deep-seated branch, placed under the middle of the gluteus muscle, divides into Superior and Inferior branches.

The branches of the Superior, are distributed on the dorsum of the os ilium, and the gluteus me-

dius muscle; and some small branches pass downwards on the gluteus medius and minimus.

The Inferior branch is distributed upon the inferior gluteus, superior geminus muscle, and subdivides suddenly into a number of small branches, which are lost upon the trochanter major, and which inosculate with the smaller ascending branches derived from the perforating branches of the arteria profunda femoris.

Of the Anterior Branches of the Posterior Iliac Artery.

The Umbilical Artery, has been already described.

The *arteriæ vesicales*, are sometimes branches of the umbilical, sometimes of the pudic, and sometimes of the hypogastric artery.

Arteria Uterina.—This is also a branch of the anterior, and has been already described.

Arteria Hæmorrhoidalis Media.—This artery runs on the fore-part of the intestinum curvum, and anastomoses with the hæmorrhoidalis interna.

From this artery, there are branches derived, which go to the under-part of the bladder of urine, to the vesiculæ seminales, and prostate gland; and in the female, to the vagina.

The Arteria Pudenda Communis, has been described above.

ARTERIA OBTURATORIA.—This artery is generally a branch of the posterior iliac artery, but sometimes it takes its rise from the epigastric artery, as has been noticed in the article *Hernia*, in the second volume.

This artery passes along the upper edge of the obturator internus muscle, and then through the hole in the ligamentous membrane, which shuts up the foramen thyroideum.

The artery then divides into *external* and *internal branches*, which are distributed upon the obturator muscles, the ligament of the hip-joint, and origin of the vastus internus muscle.

The branches of this artery anastomose with the circumflex, and the profunda femoris.

PUDENDA COMMUNIS.—This artery has been already described.

ISCHIATIC ARTERY.—This artery leaves the pelvis at the lower margin of the pyriform muscle, accompanied by the sciatic nerve, and is covered by the gluteus maximus muscle. It descends in the hollow between the great trochanter of the thigh-bone and the tuberosity of the ischium, along with the sciatic nerve.

Before leaving the pelvis, it detaches branches to the intestinum curvum, obturator internus, and pyriform muscles; and, without the pelvis, it detaches the arteria coccygea, which passes along the posterior sacro-sciatic ligament, and gives branches to the levator ani, coccygeus muscle, the fat and bones of the coccyx.

A branch of this artery accompanies the sciatic nerve for some way down the thigh.

A small branch of this artery communicates with the perforating branches of the arteria profunda femoris.

Of the Anterior Iliac Artery and its Branches.

The trunk of this artery sweeps along the inner edge of the psoas muscle, and is situated on the outer side of the vein: it passes beneath the crural arch, and is then called *femoral artery*.

There are two considerable branches detached from the anterior iliac artery before it leaves the pelvis, the Epigastric Artery and Circumflex of the Os Ilium.

There is much variety as to the origin of the epigastric artery, (as has been explained in the article on Hernia): generally it takes its rise about an inch from the crural arch; it is then reflected upwards and inwards behind the spermatic chord, and on the inner-side of the upper abdominal aperture. The artery then passes behind the rectus abdominis muscle, and ascends to meet with the smaller branches of the internal mammary artery, upon the back-part of the rectus abdominis.

The epigastric artery sends a small branch, which is distributed upon the pubal side of Gimbernat's ligament; a second, which passes through

the inguinal canal; a third to the spermatic chord, which communicates with the spermatic artery.

There are many small branches of this artery, which are distributed upon the integuments of the abdomen, and which sink into the substance of the recti and other muscles of the abdomen; and it also anastomoses with the thoracic, intercostal and lumbar arteries.

CIRCUMFLEX ARTERY of the ILIUM.—This artery arises opposite to the epigastric artery; runs along the internal edge of the crural arch; follows a retrograde course, and reaches the spine of the os ilium; and as it ascends, divides into branches, which supply the internal oblique and transverse muscles of the abdomen, and communicate with the lumbar and ilio-lumbar arteries, and with the inguinal branch of the arteria profunda femoris.

This artery also gives branches to the psoas, sartorius and iliacus internus muscles.

Of the Femoral Artery and its Branches.

The femoral artery, surrounded by fat and the lymphatic glands of the groin, lies over the ball of the thigh-bone, and covers the corresponding vein; is afterwards lodged in the hollow at the upper and inner part of the thigh, having the adductor muscles on the inner side, and the rectus and sartorius on its outer side.

The artery is covered by the fascia lata of the thigh.

The first artery derived from the superficial femoral artery, is the superior EXTERNAL PUDIC, which crosses the heads of the pectineus and graciles muscles, and gives branches to the inguinal glands, to the scrotum, and anastomoses with the branches of the epigastric artery. The small branch of this artery proper to the scrotum, in some cases of large scrotal herniæ, attains a large size.

A little lower down, the INFERIOR and EXTERNAL PUDIC ARTERIES take their rise.

These arteries are subdivided into several small branches, which are distributed upon the heads of the triceps adductor femoris; the pectineus muscle; the skin of the scrotum; the integuments of the penis; and also upon the skin of the abdomen which covers the ossa pubis; and several of the branches of this artery anastomose with those of the penis.

About two inches under the crural arch, the femoral artery divides into two great branches, which are nearly equal in size. The branch which follows the same direction with the trunk has been called the *anterio superficial femoral artery*, and the other, which sinks deep among the muscles, the *arteria profunda femoris*.

The trunk of the superficial femoral artery descends obliquely towards the inner side of the thigh;

and, about the middle of the thigh, is situated on the triangular space between the vastus internus muscle and the second head of the abductor muscle; and the sartorius muscle passes across it.

The PROFUNDA FEMORIS, situated behind the superficial femoral, passes backwards, and is situated in the triangular cavity between the iliacus internus and pectineus muscle.

The following branches are derived from the arteria profunda femoris.

The EXTERNAL CIRCUMFLEX, which passes under the sartorius and rectus muscles, and towards the root of the great trochanter, is distributed on the rectus cruris; and, perforating the fascia of the thigh, is spent on the skin over the hip. A large branch passes down the inside of the vastus internus, and communicates with the superior articular artery of the knee.

The INTERNAL CIRCUMFLEX sinks deep between the pectineus, iliacus internus, and psoas muscles; it then passes into the space between the greater and lesser trochanter.

An *external pudic artery* is sometimes derived from the internal circumflex, but more commonly from the superficial femoral artery.

This artery crosses the upper portions of the pectineus and gracilis muscle, and is subdivided into a number of small branches, which are distributed upon the inguinal glands, the scrotum, and pubes.

A branch of this artery anastomoses with a branch of the obturator artery. Small branches of this artery also anastomose, upon the capsular ligament of the hip-joint, with those of the gluteal artery.

The internal circumflex then passes behind the lesser trochanter, and is subdivided into many small branches, some of which sink into the substance of the triceps adductor femoris, others supply the quadratus femoris, and obturator internus muscles.

A descending branch of this artery passes outwards from beneath the quadratus femoris, anastomoses with the branches of the ischiatic artery, and terminates upon the semimembranosus, semitendinosus, and adductor muscles.

The circumflex arteries also anastomose with the arteries of the periosteum.

Professor SCARPA has bestowed much pains in describing and in representing this anastomosis. Vid. his Tab. 2d, affixed to his book *Sull Aneurisma.*

The branches proper to the periosteum, are derived from the external circumflex, which enters the cruralis muscle, and which anastomose with other branches which come under the vastus internus muscle.

About the middle of the thigh, a considerable branch is derived from the arteria profunda, which is distributed upon the periosteum, and which di-

vides into ascending and descending branches; the former of which, join with the smaller branches of the external circumflex artery, and the latter with the superior articulating branches of the popliteal artery, and also with a branch derived from the popliteal artery, which is distributed upon the periosteum, covering that part of the thigh-bone in the vicinity of the condyles.

The arteria profunda femoris, inclines towards the inner side of the thigh, after giving off the circumflex arteries, and is lodged in the cavity between the second head of the adductor muscle, and the vastus internus muscle.

There are *four perforating arteries*, derived from the profunda femoris.

The first *perforating artery*, after having passed through the adductor muscle, appears on the back thigh, about two inches below the quadratus femoris, and divides into two branches; one of which runs upwards to the great trochanter, is subdivided into small branches upon the gluteus maximus muscle, and anastomoses with the smaller branches of the gluteal artery. The other branch passes into the substance of the vastus externus muscle, and anastomoses with the smaller ramifications of the external circumflex artery.

Dr RYAN made for me a very beautiful preparation of the arteries above described, in which,

the superior branch of the profunda ascended upon the posterior part of the long head of the biceps flexor cruris, and divided into two small branches which inosculate with two similar branches of the ischiatic artery, so that, upon the above mentioned muscle, *an arterial circle is formed* by the conjoined branches of the ischiatic and superior perforating branch of the profunda femoris.

In this preparation, there was *another arterial circle* formed upon the dorsum of the os ilium, immediately above the acetabulum, by the conjoined branches of the external circumflex artery, and a small gluteal artery.

I have made the more particular mention of these *arterial circles*, or as they may be called *double anastomoses*, found in the above described case, as SCARPA has not represented such arterial circles in his very splendid and accurate Plates of the arteries of the head, neck, superior and inferior extremities.

In most cases, the perforating branches come off separately, as mentioned below; but, in other instances, I have seen them derived from a common trunk.

The second *perforating branch*, passes through the adductor maximus muscle, and divides into a number of small branches, which are distributed upon the biceps flexor cruris.

The third *perforating artery*, passes over the short head of the biceps flexor cruris, and after-

wards dips into the substance of the vastus externus, and anastomoses with the branches of the external circumflex muscle.

The branches of the fourth *perforating artery*, are distributed upon both heads of the biceps; and some of its branches are distributed upon the semitendinosus, and semimembranosus muscles.

About two-thirds down the thigh, the trunk of the superficial femoral passes obliquely backwards between the tendon of the adductor magnus and the thigh-bone, and reaches the back-part of the thigh-bone, and then descends into the ham, where its cellular membrane is lodged in fat, and covered by the corresponding vein, and the sciatic nerve, and well protected by the condyles of the thigh-bones.

Of the Popliteal artery.

There are five branches of the popliteal artery, called its *articular branches*, three of which are placed on the inner, and two on the outer side of the knee-joint: these branches anastomose with each other, and with the branches of the arteria profunda femoris, and also with those of the superficial femoral artery.

The first branch of the popliteal artery ascends from the ham, towards the inner and lower part of the thigh, and is lost in the vastus internus

muscle, by which it is covered; it anastomoses with the branches of the superficial femoral, and also with the branches of the superior internal articular artery.

The second branch, called SUPERIOR INTERNAL ARTICULAR ARTERY, descends to the inner condyle of the thigh-bone, and anastomoses with the external articular artery.

This artery afterwards divides into *two branches*, one of which passes over the capsular ligament of the knee-joint, and assists in forming a net-work of bloodvessels which covers the patella, and a still smaller branch passes on the edge of the internal semilunar cartilage, and enters the cavity of the knee-joint.

The deeper-seated branch passes along the capsular ligament, and divides into a number of small arteries, which enter the internal condyle of the thigh.

The INFERIOR INTERNAL ARTICULAR ARTERY ascends, and is covered by the tendinous aponeurosis of the semimembranosus, sartorius and semitendinosus muscles; and by the internal lateral ligament of the knee; and it anastomoses with the preceding artery.

There are also two *external articular arteries*, a Superior and an Inferior, derived from the popliteal artery: the former supplies the muscles in the vicinity of the outer condyle of the thigh-bone and the external lateral ligament; the latter,

which, at its origin, is covered by the gastrocnemius muscle, becomes more superficial at the head of the fibula, sends a few small branches to the cavity of the joint, and anastomoses with the superior external, and superior internal articular artery, under the ligament of the patella.

The fifth articular artery has been called the *arteria media:* it is situated between the condyles of the thigh bones, and suddenly subdivides into many small branches, which are distributed upon the capsular ligament and fat of the posterior part of the knee-joint.

The popliteal artery descends between the heads of the gastrocnemii muscles, to which it gives several branches, called *sural;* and opposite to the under edge of the popliteus muscle, divides into two large branches, the TIBIALIS POSTICA and ANTICA.

The ANTERIOR TIBIAL ARTERY perforates the upper part of the interosseous ligament; descends along the anterior surface of it between the tibialis anticus and extensor digitorum longus muscles. Above the ancle, it is situated upon the fore-part of the tibia; it then passes under the annular ligament; then between the extensor longus pollicis and tibialis anticus muscle, and passing along the upper part of the foot, at the root of the first metatarsal bone, it passes through to the sole of the foot, and communicates with the external plantar artery.

In this course, this artery gives off the following branches: The *recurrent*, after it has passed through the interosseous ligament, which is spent upon the muscles of the upper part of the leg, and which anastomoses with the inferior articulating artery of the knee-joint:

A number of *small branches to the muscles* on the fore-part of the leg:

The *external* and *internal malleolar arteries*, which supply the ancle-joint and neighbouring part of the tarsus:

The *tarsal arteries*, which run along the extensor digitorum brevis:

The *metatarsal artery*, which runs towards the root of the little toe.

The continuation of the artery proceeds between the extensors of the great and smaller toes; and the principal part of the artery passes to the sole of the foot between the metatarsal bones of the great and second toes.

There are a few branches detached from the artery before it reaches the sole of the foot, which are distributed upon the metatarsal bones of the toes.

The POSTERIOR TIBIAL ARTERY is situated under the soleus muscle; it divides, about an inch below the rise of the tibialis antica, into the Tibial and Fibular arteries.

The FIBULAR is the smaller of these branches; it runs down the leg along the fibula, between the

tibialis posticus and flexor longus pollicis; and, near to the bottom of the leg, divides into the anterior and posterior peroneal branches. The *peronea anterior* passes through the interosseous ligament, and communicates with the external malleolar arteries. The *peronea posterior* descends behind the external malleolus to the outer and back part of the foot, and anastomoses with the external malleolar and external plantar arteries.

The posterior tibial artery, placed between the tibialis posticus and flexor communis digitorum, follows the course of the tibia to the lower end of that bone; and becoming more superficial, is situated between the inner ancle and the tendo achillis.

There are several small branches detached from the posterior tibial artery to the adjacent muscles, and several small branches to the os calcis, which communicate with the smaller branches of the anterior tibial artery.

The trunk of the artery then passes to the sole of the foot, and before passing behind the abductor pollicis, divides into the INTERNAL and EXTERNAL PLANTAR ARTERIES.

The INTERNAL PLANTAR ARTERY, is placed on the inner-side of the sole of the foot, between the abductor pollicis, and tendinous aponeurosis of the sole.

From this artery, several small branches are detached, which are proper to the muscles and integuments of the sole of the foot.

This artery passes under the flexor longus pollicis pedis, anastomoses with the plantar arch, and gives a branch, which supplies the outer-side of the great toe, and one side of the toe next to it.

The Plantaris Externa, which is larger than the internal plantar artery, passes between the flexor brevis digitorum pedis, and flexor accessorius, till it reaches the metatarsal bone of the little toe.

This artery detaches a branch to the under and outer part of the heel, which communicates with the branches of the anterior tibial and fibular arteries, and several branches to the flexor muscles of the toes.

This artery forms an arch between the flexor muscles, and the metatarsal bones of the small toes, and the root of the great-toe ; and from that arch, branches are sent to the interossei muscles, also three large digital branches, which, at the root of the toes, divide into two branches, which supply each side of the toes ; and which, at the points of the toes, are united.

The perforating branch of the anterior tibial artery, joins the plantar arch, so as to form a free communication between the arteries of the upper and under side of the foot.

Sect. II.

OF DEVIATIONS AS TO THE COURSE OF THE ARTERIES OF THE INFERIOR EXTREMITIES.

The arteries of the Inferior Extremities are much more constant as to their course, than those of the Superior Extremities.

The femoral artery commonly divides into its two great branches, the superficial femoral, and the arteria profunda femoris, about two inches below the crural arch, or Poupart's ligament. In some cases, however, I have seen the profunda detached immediately under Poupart's ligament, and, but very rarely, as low as three inches below Poupart's ligament.

There is also considerable variety as to the origin of the circumflex arteries, which sometimes take their rise from the superficial femoral artery.

The tibial artery sometimes takes its rise lower than usual, sometimes as low as the middle of the tibia.

The posterior tibial artery is sometimes smaller than the fibular artery.

Mr A. Burns, has stated, that he had observed one or other of the tibial or fibular arteries altogether wanting.

Sect. III.

OF THE VEINS OF THE INFERIOR EXTREMITIES.

There are two sets of veins in the inferior extremities, a *subcutaneous* and *deeper-seated* set, which communicate with each other freely and repeatedly.

The superficial veins of the inferior extremities, which are situated under the skin, are united into two trunks, called Venæ Saphænæ.

The vena saphæna-minor is formed by the veins of the outer side of the foot.

This vein ascends on the outer side of the ancle; and on the back of the leg upon the gastrocnemius externus, and terminates in the popliteal vein.

The Vena Saphæna Major, formed by the veins on the upper part of the foot, runs along the inner ancle and inner edge of the tibia, and to the inner and upper part of the thigh, where it passes through the fascia lata of the thigh, and terminates in the deep femoral vein.

The deeper-seated set of veins, or venæ comites satellites, accompany the arteries.

The tibial, fibular and sural veins, terminate in the popliteal vein, which lies over the popliteal artery.

The femoral vein receives all the veins which correspond with the branches of the femoral artery, and those of the arteria profunda.

The veins, from the inguinal glands and external organs of generation, are also joined to the deep femoral vein, which passes under the crural arch: it is then named *anterior iliac vein*.

The anterior iliac vein receives the circumflex, epigastric, and sometimes the obturator veins. The hypogastric vein, formed by the conjoined veins, which correspond with the branches of the hypogastric artery, is united with the iliac vein. The anterior and posterior iliac veins form the common iliac; and by the union of the common iliac veins, the VENA CAVA INFERIOR is formed, which, at its origin, receives the sacral and lumbar veins.

SECT. IV.

OF THE LYMPHATIC VESSELS OF THE INFERIOR EXTREMITIES.

THERE is a superficial and deeper-seated set of lymphatic vessels in the inferior extremities, the former are disposed under the skin, and imbedded in the fat and cellular membrane; the latter accompany the branches of the arteries.

The lymphatic vessels form a plexus over the toes, from which many lymphatic vessels pass over the top of the foot to the inner part of the leg.

There is another set of lymphatic vessels on the outer side of the foot, which cross over the front of the tibia, so as to reach the popliteal glands, which are situated around the popliteal artery.

There are a number of lymphatic vessels on the inner side of the thigh, which follow the same course as the vena saphæna major, and lead to the inguinal lymphatic glands.

The inguinal lymphatic glands vary in number and size; frequently there are only five or six distinct glands: on other occasions, a greater number, and they are disposed in an upper and an under cluster; and some of them lie upon the tendinous aponeurosis of the thigh, but oftener beneath it.

The lymphatic vessels of the thigh enter the lower cluster; but there are some of them which are not connected with any of the lymphatic glands.

The deeper-seated lymphatic vessels, which are less numerous than the superficial set, accompany the arteries, and are placed on each side of the arteries.

They arise from the sides of the toes; accompany the plantar arteries; and running up the leg, accompany the posterior tibial artery. There

are also lymphatic vessels which accompany the tibial and fibular arteries, and these are connected with the popliteal glands, from which three or four lymphatic vessels pass upwards, and accompany the superficial femoral artery, and at length are connected with the inguinal glands.

The lymphatic vessels of the scrotum, penis and glutei muscles also enter the inguinal glands.

Sect. V.

OF THE NERVES OF THE LOINS, AND INFERIOR EXTREMITIES.

The nerves of the loins and inferior extremities are derived from the *sympathetic, lumbar* and *sacral nerves.*

Of the Sympathetic Nerves.

The Sympathetic Nerves, after supplying the abdomen, approach each other upon the anterior part of the lumbar vertebræ, between the psoas muscle and the tendinous crura of the diaphragm. These nerves descend, then pass over the anterior part of the os sacrum, at the inner sides of the foramina of the os sacrum, and terminate upon the surface of the ossa coccygis, when they are united by a transverse nerve.

The sympathetic nerves, during their course to the ossa coccygis, are united with the lumbar and sacral nerves by ganglia.

Of the Lumbar Nerves.

The five pairs of LUMBAR NERVES are connected with the sympathetic nerves, and with each other.

The first pair of LUMBAR NERVES is connected with the twelfth dorsal, and with the second lumbar. This pair of nerves furnishes branches to the muscles of the loins, scrotum, and to the muscles of the upper parts of the thighs.

The second pair of LUMBAR NERVES perforates the psoas muscles, to which it gives branches: and detaches also the spermatic nerves, which descend along the spermatic vessels; and above the upper abdominal aperture, divide into two branches, one of which is distributed upon the pubes, scrotum and testis of the male, and upon the round ligament of the female uterus and external parts of generation; and the other branch creeps along the femoral artery, and terminates on the forepart of the thigh. A third branch passes behind the psoas, and across the iliacus internus, and is distributed upon the muscles of the upper and inner part of the thigh, and terminates upon the vastus internus, near to the knee.

Branches of the second, third and fourth lumbar nerves form a nerve, which has been named Obturator, as it passes through the aperture in the ligamentous membrane, which shuts up the foramen obturatorium. This nerve supplies the obturator internus and pectineus muscles, and then divides into two parts, which are distributed upon the adductor muscles of the thigh.

The third and fourth Lumbar pairs of nerves are considerably larger than the preceding, and from them the following nerves are derived.

The crural nerve, which detaches branches to the iliacus internus and psoas; and passing behind the crural arch, is distributed upon the muscles and skin of the upper and lateral parts of the thigh, and is subdivided into *subcutaneous branches*, which are spent upon the middle, fore and inner part of the thigh, and *into deeper-seated and larger branches*, which supply the pectineus muscles, the sartorius, triceps, adductor femoris, and the four large extensor muscles of the leg.

A branch of the subcutaneous branch accompanies the vena saphæna, and has been called by Fischer the *Nervus Saphænus*.

This nerve supplies the inner and fore part of the leg, and is continued to the upper and inner part of the foot.

This nerve descends between the sartorius and triceps muscles, and reaches the inner side of the tibia; and under the knee, it detaches a branch, called the *Nervus Saphænus minor*, which is sub-

divided into very minute fibrils upon the inner and back part of the leg, and terminates behind the inner ancle.

Of the Sacral Nerves.

The sacral nerves consist of an *anterior and posterior fasciculus*; the anterior nerves are large, the posterior very small, and distributed upon the back part of the os sacrum and the glutei muscles.

The anterior sacral nerves fill up the holes in the anterior part of the sacrum, and are united with each other, and with the branches of the sympathetic nerve.

The first, second and third sacral nerves join with the fourth and fifth lumbar nerves, and form the SCIATIC nerve, the largest nerve of the body.

The sciatic nerve passes through the notch of the os ilium; then between the tuber ischii and trochanter major, where it is covered by the gluteus maximus. The sciatic nerve descends in the back part of the thigh between the long flexor and adductor maximus, and then into the ham. In this course, it gives off small branches to the scrotum of the male, and to the labia of the female; and to the perineum; to the long head of the biceps; and a few subcutaneous branches, which terminate in the skin of the calf of the leg.

The POPLITEAL NERVE covers the popliteal bloodvessels of the ham, and is divided below the knee into an external and internal branch, or into a fibular and tibial nerve.

The FIBULAR NERVE detaches the cutaneous nerve, which supplies the gastrocnemius muscle; a second branch, which passes to the outer part of the leg, and terminates in the same side of the foot; a third branch, which perforates the peroneus longus, and which ends in the middle of the outer part of the foot.

The fibular nerve also detaches deep-seated branches; a branch to the peroneus longus; a branch to the tibialis anticus; to the extensor pollicis, and small nerves which adhere to the coats of the tibial artery.

A branch also, which accompanies the anterior tibial artery and its ramifications.

The TIBIAL NERVE passes between the heads of the gastrocnemius; perforates the gastrocnemius internus; passes between the flexor digitorum longus and the gastrocnemius, and along with the posterior tibial artery, to the under part of the leg.

The branches of this nerve supply the heads of the gastrocnemius, the tibialis posticus, flexor digitorum, and flexor pollicis muscles.

The TIBIAL NERVE then passes in the hollow of the os calcis, and divides into the EXTERNAL and INTERNAL PLANTAR NERVES.

The external plantar nerve gives branches to the heel; and passing along the foot, divides into

three principal branches. The two first pass forwards to the fourth and fifth toes, and outer side of the little toe. The third branch forms an arch, and corresponds with the external plantar artery; and gives branches to the muscles of the little toe, to the lumbricales, interossei and transversalis pedis, and terminates in the muscles of the great toe.

The INTERNAL PLANTAR NERVE is situated on the inner side of the sole of the foot, and gives off branches to the abductor pollicis, flexor digitorum brevis, and lumbricales muscles.

This nerve afterwards sends off four large branches, which accompany the arteries; pass along the plantar sides of all the toes, excepting the little toe and the outer side of the fourth toe, and terminate in the extremities of the toes.

CHAPTER VII.

OBSERVATIONS ON THE DISTRIBUTION AND ANASTOMOSES OF THE ARTERIES, VEINS, LYMPHATIC VESSELS, AND NERVES.

THE plan which has been adopted in the preceding Chapters, in describing the course of the ar-

teries, veins, nerves and lymphatic vessels, differs from that of any author with whose works I am acquainted, and is, in my mind, superior on account of the view which it exhibits of their relative situation.

SECT. I.

OBSERVATIONS ON THE DISTRIBUTION AND ANASTOMOSES OF THE ARTERIES AND VEINS.

THE limits of these Outlines have precluded me from subjoining Pathological Observations respecting the wounds or diseases of particular arteries and veins, and have compelled me to confine myself solely to description. I have endeavoured to describe particularly the inosculations between the several branches of the arteries and veins; upon which very important and extensive subject it seems necessary to subjoin a few general reflections, which tend not only to enlarge our view of the operations of the animal economy, but also to explain the principles upon which the more modern and improved method of treating wounded or diseased arteries is founded.

There are various purposes served by the anastomoses of the arteries:

1st, By means of the anastomoses of the smaller ramifications of the arteries, circulation is main-

tained where it might have been obstructed by the sudden and unequal pressure, to which particular organs are exposed, occasioned by distention, contortion, or the pressure of neighbouring organs, as in the case of the stomach, intestines, bladder of urine, and womb.

The blood, by means of the anastomoses, may occasionally pursue even a retrogade course.

The extremities of the body, from various causes, are liable to partial pressure: hence there are numerous anastomoses at the shoulder, elbow, hip, and knee joints, so that modern surgeons do not now hesitate to throw ligatures upon the subclavian, axillary, humeral, iliac, femoral, or popliteal arteries, being fully aware, that the circulation of the blood will be maintained by means of the lateral anastomosing arteries.

2d, It is highly probable, that the still smaller ramifications of the arteries, are in a similar manner subservient to the larger anastomosing arteries, as in the case of the extremities; and I have no doubt, that the anastomoses upon the periosteum of the thigh-bone, so beautifully represented by SCARPA in his Treatise upon Aneurism, have a considerable share in supporting the circulation, when the main trunk of the artery of the thigh has been obstructed.

3d, The anastomoses of the arteries may perhaps serve other useful purposes in the animal economy, as they are not merely proper to those organs which are exposed to the influence of pressure,

but also common to the brain and heart; those organs upon which life more immediately depends: and likewise to the liver, salivary glands, pancreas, and other secretory organs.

4th, Anastomoses are also essential to the regeneration of parts which have been injured or detached.

There is an increased action of vessels in every part of the body, which is in a state of growth; the bloodvessels of that part become larger, and more freely and frequently communicate with each other, than in other parts of the same organ.

By means of anastomoses of vessels, a part, which has been separated, adheres and grows; thus, a bone adheres to a bone, a muscle to a muscle, a nose may be supplied, or a tooth may be transplanted.

By the inosculation of vessels, even parts of different structure are united; thus, for instance, Mr Du Hamel found, that the spur of a cock may be inserted into the comb of the animal, where it continued to live and to grow; and Mr Hunter found, that a human tooth adhered to a cock's comb *.

* Upon this very curious subject, the reader is referred for further information to the works of Garengeot, Traité des Operat. tom. iii.—Taliacotius.—Vesalius, Chir. Magaz. cap. ix.—Heister.—Fleurant.—Du Hamel, Mem. de l'Acad. des Sciences, 1746; and Alix. Observat.

The wonderful extent of the power of the anastomosing vessels, has only of late been fully ascertained.

Modern investigation and experiment have proved, that an obstruction of the aorta or vena cava, does not prove fatal.

A case is detailed at considerable length in Volume Second of M. DESAULT's Journal, in which the aorta below its arch was much contracted.

He says, " qu' elle avoit tout-au-plus la grosseur d' un tuyau de plume à ecrire." He has added, " La partie de cette artere qui se trouvoit au dessus du retrécissement, etoit à peine delatée, et celle qui etoit au dessous conservit son calibre ordinaire."

The subclavian artery, and its branches, the external thoracic, the internal mammary, the lower intercostal derived from the aorta, and the epigastric arteries, were much enlarged, and, with the exception of the first artery, were tortuous.

In short, in this very remarkable instance, the greater part of the blood, instead of reaching the inferior extremities by the medium of the usual channel, the aorta, had descended by the internal mammary and epigastric arteries.

Mr ASTLEY COOPER has repeatedly thrown ligatures upon the aortæ of dogs, of which he has published the following account:

" I was anxious to ascertain when even the aorta was tied, if the blood would still find its course by anastomosis.

" It is now more than two years ago that I opened the abdomen, by an incision of about three inches in length, close to its junction with the loins, and turning aside the peritoneum with my finger, I felt the aorta pulsating, and passing a blunt hook under it, easily put a ligature around it.

" During the last winter, assisted by my friends Mr White and Mr Dean, two of our most promising and intelligent pupils, I repeated the experiments, and have the honour of shewing to the Society the aorta tied and divided, the animal having survived the experiment, and maintained his usual health; the ligatures coming away as other ligatures upon arteries, and a successful injection having been made of the body, the anastomosing vessels are beautifully seen. These were sufficiently large and numerous to allow of a free injection of the femoral vessels.

" Some degree of weakness is produced in the hinder extremities by a ligature made upon the aorta; but it is not sufficient to prevent the animal from using them with great freedom, and would scarcely be observed by one who knew nothing of the experiment.

" Previous to the animal being killed, the femoral artery and vein were laid bare; the blood

in the artery was florid as usual, and passed with a motion that was pulsatory, although weaker than natural."

That distinguished author very lately sent me the result of one of his experiments.

Mr Fyfe *junior*, who dissected the Dog, has favoured me with the following account of what he had observed:

The aorta was tied about an inch and a half above its division.

The anastomosis between the superior and inferior mesenteric arteries was very much enlarged; and that artery described a tortuous course.

The four uppermost lumbars on each side were very much enlarged.

There was an anastamosis between the third and fourth lumbar on the right side, at the side of the lumbar vertebræ.

There were two very large anastomoses between the second and third lumbars, lying between the vertebræ and muscles of the loins on the left side; and another between the third and fourth of the same side.

A small branch ran from the second lumber artery, to near the bifurcation of the aorta.

The first and second lumbars came off above the obliteration of the aorta; the third on the right side seems to have been included between the two ligatures.

The third left lumbar came off from the right side of the aorta immediately below the obliteration.

The fourth and fifth on each side came off near the bifurcation of the aorta. The latter are very small, and do not seem to have made any anastomoses with the other branches.

The epigastric arteries seemed to be enlarged.

The knowledge which we have gained respecting the anastomosing arteries, has paved the way to a new and improved method of treating wounded or diseased arteries, by which many patients, who, twenty or thirty years ago, would have been suffered to die, are now rescued from the brink of the grave*.

* My Father's experiments upon the arteries of animals, the observations of Mr WHITE of Manchester, upon the humeral artery, of Mr ASTLEY COOPER, upon the arteries of the extremities, have shewn how much the lateral anastomosing arteries are enlarged when the main trunks have been obstructed.

Mr A. COOPER's history of the dissection of a limb, on which the operation for popliteal aneurism had been performed, is too important to be omitted. He has observed, " The femoral artery, which is necessarily obliterated by the ligature, was here converted into a cord from the origin of the arteria profunda down to the ham. The whole of the popliteal artery was also changed into a similar substance; and thus the natural channel of the blood from the groin to the lower part of the knee was entirely destroyed. The muscles, therefore, which usually receive bloodvessels from the femoral artery, as the sartorius, the rectus, and the vasti, had no branches but from the arteria profunda and circumflex arteries; and the articular arteries from

My Father has contributed considerably to the improved method of treating aneurisms; of which,

the popliteal, although they were still capable of receiving blood, derived it, not from the popliteal artery, but from the communicating vessels of the profunda.

"The arteria profunda formed the new channel for the blood. Considerably enlarged in its diameter, although still not equal in size to the femoral artery at the groin, it took its usual course to the back of the thigh on the inner side of the thigh-bone, and sent branches of a larger size than usual to the flexor muscles of the leg, and just midway on the back of the thigh, it began to send off those arteries which became the support of the new circulation.

"The first artery sent off, passed down close to the back of the thigh-bone, and entered the two superior articular branches of the popliteal artery, which vessels supply the upper part of the knee-joint.

"The second new large vessel arising from the profunda at the same part with the former, passed down by the inner side of the biceps muscle to an artery of the popliteal, which was distributed to the gastrocnemius muscle, whilst a third artery dividing into several branches, passed down with the sciatic nerve behind the knee-joint, and some of its branches united themselves with the inferior articular arteries of the popliteal, with some recurrent branches of those arteries, with arteries passing to the gastrocnemii, and, lastly, with the origin of the anterior and posterior tibial arteries: and these new large communicating branches were readily distinguished from others by their tortuous course.

"It appears then, that it is those branches of the profunda, which accompany the sciatic nerve, that are the principal supporters of the new circulation. They were five in number, besides the two deep-seated arteries, which do not accompany the nerve.

at my particular request, he drew up the following statement:

"The external circumflex artery was considerably larger than usual for the supply of branches to the muscles on the fore-part of the thigh, but it had no branches for the new circulation.

"The obturator artery did not appear larger than usual, and although much pains were taken to trace any enlarged communicating branches between the ischiatic arteries and profunda, yet no vessels capable of receiving coarse injection could be found."

In proof of what has been affirmed, I have subjoined the history of a case, published by my late Uncle:

"A patient with an aneurism was brought to St George's Hospital. At this time the tumour was large, and extended itself far down the arm; it had still a pulsation, and the pulse at the wrist was feeble and weak. The physicians and surgeons of the hospital, upon examining the case, were of the same opinion with Mr Fordyce; they thought the tumour was situated too high up to attempt any operation, and advised only mild palliatives and anodynes to be given. After this, the swelling gradually increased, and its pulsation as gradually diminished, so that at last only a tremulous motion could be observed in it; the pulse at the wrist grew daily weaker, and at last ceased entirely. In the end of November, or the beginning of December, the tumour began to rise in the middle, and at last bursting on the 29th of December, the patient died immediately of a profuse hæmorrhage.

"Next day the body was opened in presence of all the physicians and surgeons of the hospital. The axillary artery was found to open into the large aneurismal sac, which extended above two-thirds down the arm. This sac was filled with a large lamellated polypous concretion, entirely of the same na-

"When a Student, I made an experiment along with Mr EMMET, afterwards State Physician in Ireland, of tying up and cutting both *carotides communes* of a dog, which was mentioned then to the Students of Anatomy; and of which, an account was afterwards published by Dr EMMET in Ireland, on the supposition, that such an operation might be useful to persons labouring under epilepsy and other disorders.

"In the year 1759, when I began to deliver the whole course of lectures on Anatomy in this University, I shewed to the Students, and continued to do so annually, that the humeral artery did not divide into its radial and ulnar branches, till it had got about an inch below the joint of the elbow; and, therefore, that the wound commonly made in the artery on bloodletting at the elbow, was made in the trunk of the humeral, and not in the radial artery, as Dr WM. HUNTER had supposed.

ture as those generally found in large aneurisms of long standing; and along with it a quantity of fluid and grumous blood. The beginning of the sac seemed to be continued with the coats of the artery, but the rest of it to be formed of the neighbouring cellular membranes, &c. in the same manner as the sides of any common encysted tumour. The humeral artery run behind the aneurismal sac, *but was impervious for about half an inch, immediately below where the axillary artery opened into the large sac, its sides being grown together,* as we found by making a hole into the artery below, and introducing a probe upwards, and then cutting open the vessel upon the probe till we came to the part where it was stopped."

"To shew, in fact, that the humeral artery might be tied up without occasioning mortification, I mentioned, that in several cases of bastard aneurism, my Father had performed this operation with success: and, later than this period, I told them in my courses of lectures, that I had witnessed four such successful cases.

"To prove this still more evidently, I tied up in a pig, the trunk of the humeral artery, upwards of an inch above the elbow; and, about a month thereafter, killed the pig, injected its arteries, and had a drawing and engraving of it made by the late Mr Thomas Donaldson, which I preserve, along with the preparation, in which the anastomosing vessels, somewhat enlarged, are distinctly seen.

"Soon after this, in the year 1760, I received from my brother, Dr Donald Monro, Physician in London, the account of a case of true axillary aneurism, which I read then to the Philosophical Society of Edinburgh; and, in order to render the description of it more intelligible to them, I directed a painter to take a sketch of the axillary vessels, from a table of them published by Dr Haller; and, upon this, to engrave a figure of the aneurism, which was published by the Society in the next volume of their Transactions, in 1770.

"In this case, my brother found a hole in the axillary artery, leading into the aneurismal sac: and, below this place, *the sides of the bottom of the*

axillary artery, or top of the humeral artery, had coalesced; owing, I suppose, to the pressure made on the artery by the aneurismal sac.

"Upon the above case, I used in my Lectures to make two observations, to-wit,

"That, in the first place, The arm, as well as the life of this person, might have been saved by a ligature of the subclavian or axillary artery; and, in the next place, That such an operation might be practised in the case of an aneurism or wound of any artery of the superior extremities.

"After this, in the year 1787, I sent to our Infirmary, a boy of twelve years of age, who had been wounded in the middle of his anterior femoral artery, with a pen-knife, who was recommended to my care by Mr Wetherstone, Surgeon in Lauder. He was cured by tying up the trunk of that artery: and, very lately, I had the satisfaction of seeing him in my house, stout in his limbs, and without a halt in his walk, or other sign of lameness.

"Still later, in the year 1797, a man about fifty years of age, with an aneurism, of the size of an English pint-bottle, in his left groin, was recommended to my care by Mr Paterson, an eminent surgeon in Berwick. I put this patient into the hands of Dr Wardrop, one of the best surgeons and operators in this city, who agreed with me, that an operation ought to be performed without delay; but, unfortunately, Dr Wardrop was prevented from executing his purpose by other surgeons, who did not suppose that the operation

would be attended with success, and the patient died soon thereafter, by the bursting of the sac. I procured, and still preserve the aneurismal sac, which began at the top of the anterior femoral artery, immediately below where the external iliac, after sending off the epigastric artery, divides into its anterior and profunda branches.

"From a manuscript copy of my Lectures, which was taken in short-hand, in the winter 1770–1, by Mr Thorburn, the following passage is extracted:

"We are led from these facts, to make the application to other cases; and, particularly, I may allege, that there is much probability *we should be able to save the arm or the leg by making ligatures upon their arteries, near to their very beginnings*; for water, squirted into them, passes freely by their lateral communications to their lower parts. But the chance is somewhat less in the legs, as a greater size of member must be nourished by similar, but smaller vessels. In one case, which you will find in the Physical and Literary Essays, the sides of the humeral artery were found grown together, by the compression of an aneurismal sac, the lateral branches probably dilating as the aneurismal tumor formed and increased."

I should be extremely culpable, and at the same time unjust, did I not bestow the praise that is due to those distinguished surgeons, Messrs J. Hunter, Abernethy, Astley Cooper, and Freer, who, by their precepts and example,

have contributed to the introduction of the new and improved method of treating aneurisms.

Mr Astley Cooper has prosecuted this subject with his usual and laudable zeal, by making experiments on animals, which have proved many of the remarks of my Father, and have also thrown new light upon the subject.

He has proved, that even the aorta itself may be taken up by ligature, in a sound animal, and that the blood still continues to be carried on in the posterior extremities *; that the principal

* "Any great increase in diameter of the anastomosing vessels is but slowly produced, for I have injected a limb several weeks after the operation for popliteal aneurism, without being able to force the injection through communicating vessels into the parts below. To enlarge the vessels much, it is necessary that the limb should have been employed in active exertion.

"On account of the arteries not very readily enlarging, the limbs of those who have undergone the operation for aneurism, are for a considerable time weaker than natural. They feel the influence of cold more, are more disposed to ulcerate from slight causes, and when sores are produced, have diminished powers of restoration. On account of the languor of circulation and the diminished power of resisting the influence of low degrees of heat, it is right, after the operation for aneurism, to clothe that limb much warmer than the other; for which purpose, a piece of flannel or a fleecy stocking should be applied, to prevent the sedative influence of cold.

"A man, who had undergone the operation for popliteal aneurism, complained in the evening of his leg being painful, and a dresser going through the ward, applied a lotion of the acetate of lead, and when the rags were removed on the following morning, the limb was found mortified.

trunks of the arteries may be taken up in succession in the same animal, by which the greater share of the blood is translated to the smaller anastomosing vessels *, and without producing any alteration in the habits of the animal.

Since the preceding observations upon the effects of ligatures thrown around the arteries, were published by Mr ASTLEY COOPER, he shewed me a preparation of a limb, in which the iliac artery had been tied for a large femoral aneurism, in the middle of the thigh, and in the same limb there were four other aneurisms. The man died of an aneurism which burst into

"Mr CAMPBELL, a patient of Mr CURTIS, Surgeon in Whitechapel, underwent the operation for popliteal aneurism, at a time when the weather was extremely cold. In three nights after the operation, he said his foot was benumbed, and when it was examined, it was found to be of a blue colour, and quite cold. Frictions were immediately had recourse to; first, with the hand only, and, after a time, with warm flannels, and the circulation was restored, although with considerable difficulty.

"When a ligature has been applied, it is some time before the artery below becomes obliterated. Mr FOSTER, Surgeon of Guy's Hospital, has a drawing in his possession of a case of popliteal aneurism, for which the femoral artery was tied in August; the man died in January following, and when the limb was injected, the femoral artery, below where the ligature had been applied, was found to have received a part of the injection by communicating vessels.

* Vid. London Medico-Chir. Trans. vol. ii. p. 257.

the abdomen, about thirteen weeks after the iliac artery had been tied; and as the limb had been well injected, the anastomoses of the internal iliac with the femoral artery, and arteria profunda, were well displayed.

The anastomosis between the internal iliac, and femoral artery, was by means of the internal and external pudic arteries along the penis, which arteries fully joined, and were considerably enlarged.

The anastomosis with the profunda, was by the ischiatic artery on the gluteus maximus, and by a still larger branch, which passed from the ischiatic to the profunda on the sciatic nerve.

The gluteal artery also freely anastomosed with the external circumflex artery, over the outer part of the ilium.

The obturator artery, formed free anastomoses with the internal circumflex.

The epigastric artery had its natural supply of blood cut off by the ligature on the external iliac artery; the epigastric gave off the obturator, which joined freely with the lateral sacral artery of the internal iliac, and then the epigastric received its blood from the internal iliac, by the media of the lateral sacral and obturator arteries.

Before concluding, it may not be improper to add, that the slow and gradual expansion of the lateral anastomosing arteries, affords a satisfactory explanation of the coldness of the limb, which sometimes succeeds the operation for aneurism;

suggests the propriety of the application of flannel, friction, and other means, which may tend to give vigour to the circulation of blood through the lateral anastomosing branches; and also points out the necessity of avoiding such a posture of the limb, or other causes, which may retard or stop the flow of blood through the lateral anastomosing branches of the arteries.

SECT. II.

GENERAL OBSERVATIONS ON THE DEVIATIONS FROM THE USUAL COURSE OF THE BLOODVESSELS ABOVE DESCRIBED.

FROM the preceding statement respecting the irregularities in the distribution of the carotid arteries and their branches, it follows, 1st, That much danger may result from opening the windpipe, when the thyroid artery runs in the front of that canal. 2d, That as the carotides communes sometimes divide into external and internal carotids low in the neck, this might embarrass a surgeon who was unacquainted with that fact in performing this operation for the carotic aneurism.

The irregularities as to the distribution of the subclavian arteries, are more frequent than in any other part of the vascular system: and of these, the division of the humeral artery into its radial

and ulnar branches in the middle of the humerus, or in the axilla, is the most important.

A surgeon, therefore, while operating for aneurism, should bear in mind the above irregularity; as also, that a branch of the humeral artery, as in fig. 1. of Plate XLIV., sometimes is situated immediately under the skin, and over the tendinous aponeurosis of the arm, and may be mistaken for a vein, or wounded in opening one of the subcutaneous veins.

Deviations from the common distribution of arteries, are more common in the inferior than in the superior extremities.

The attention of the surgeon should be directed chiefly to the division of the femoral artery into the superficial femoral and profunda femoris, which, supposing the body to be erect, usually takes place, about two inches beneath the crural arch.

SECT. III.

OBSERVATIONS ON THE DISTRIBUTION OF THE LYMPHATIC VESSELS.

THE lymphatic vessels are much more numerous than the arteries or veins, and very frequently communicate with each other, and are connected with several lymphatic glands in their progress to the heart.

Many of the lymphatic vessels are buried in the fat and cellular membrane immediately under the skin, and accompany the subcutaneous veins; others are deep-seated, and follow the same course as the arteries.

A knowledge of the course of these vessels points out the source and progress of many poisons which are received and propagated by absorption, suggests the most efficacious means of eradicating these poisons, or of arresting their progress into the blood; and in the case of local diseases, teaches the most efficacious means of applying the antidote.

SECT. IV.

OBSERVATIONS UPON THE DISTRIBUTION OF THE NERVES.

MANY of the nerves follow the same course as the branches of the arteries and veins.

The nerves, in their course, are connected in three different ways:

1st, The nerves are frequently conjoined at acute angles, or form plexuses; as in the axilla and loins.

2d, Nerves disposed in opposite directions are connected by their smaller branches, or the apices of these branches, forming networks; as where

the portio dura of the seventh pair joins with the second and third branches of the fifth pair.

3d, In certain parts of the body, the nerves enter a ganglion; from the opposite side of which the nerves issue out, as at the junction of the sympathetic with the dorsal nerves. Muscles, which are subservient to very different purposes, viz. the flexor muscles, are supplied by the branches of the same nerves, which is intended to lessen the danger which must otherwise have attended diseases or accidents.

"Thus," (my Father has remarked,) "let us suppose that two nerves are sufficient to supply the flexors and extensors of the fore-arm; it is evidently better for us, that the one-half of each nerve goes to the flexors, and the other half to each of the extensors, than that the whole of the first nerve should have gone to the flexors, and the other half to the extensors. For if by accident or disease, one of these nerves should be cut across, or lose its powers, we should on the first supposition, preserve one-half of the power both of flexion and extension, which would surely be preferable to our possessing fully the flexion, without any power of extension*.

It may not be improper to add, that there is little or no reason to suppose, that the energy of one fibre of a nerve can directly affect that of a neighbouring or contiguous fibre, or that the

* Vid. Nervous System, p. 46.

sympathy of nerves can depend directly on their connection in their progress.

I shall conclude this Chapter by a few observations respecting the Ganglia of the Nerves.

Ganglia are oblong bodies of an irregular form, which are connected with the great sympathetic nerve chiefly *.

In some of the ganglia, there is a peculiar kind of cellular membrane, and also fat.

The bulk of the ganglion exceeds very much that of all the nerves or bloodvessels which it receives, which led WINSLOW †, MORGAGNI ‡, and also WRISBERG, to suppose, that in ganglia the different nervous filaments are intimately intermixed, and also that a new arrangement of the medullary substance takes places within them.

The nerves to which the ganglia are attached, are distributed upon organs of involuntary motion; and though these are not under the dominion of the will, yet there is no peculiar mechanism, no peculiarity in the muscular structure

* HALLER, speaking of the Sympathetic Nerves, has observed, "Super omnes nervos ganglia sunt frequentissima, in cervice quidem tria; in thorace, lumbis, et pelvi tot, quot nervorum ex spinali medulla propagines intercostalis accepit: tum in cordis vicinia, sub diaphragmate, circa arteriæ cœliacæ et mesentericæ originem, et circa renem passim in plexubus retibus." Element. Phys. t. iv. p. 202.

† Exposit. Anat.

‡ Vid. MORGAGNI, Advers. Anat.

of these parts, to account for that very remarkable circumstance; and hence it has been concluded by Dr JOHNSTON *, that the ganglions are the instruments by which the motions of the heart and intestines are to the latest period of animal life rendered uniformly involuntary.

Ganglia have been considered by some authors, as being *analogous to the brain in office* †, as being sources of nerves, which are distributed upon the involuntary organs, and as independent of the brain, being reservoirs of nervous power, which they are capable of dispensing after the communication with the brain has been cut off.

The arguments which have been advanced in support of the above theory, are,

1st, That the organs of involuntary motion continue to exercise their functions in cases of perfect hemplegia; and it has been added, that without the interposition of ganglia, there must be a defect in the functions of the viscera of the thorax and abdomen, a loss of half their nervous power.

* Vid. Essay on the use of Ganglions, page 16.

† "Ces tumeurs ganglioformes," says WINSLOW, Expos. Anat. p. 462. 4to edition, "ou ganglions, different plus ou moins en volume, en couleur, en consistence; et on les peut regarder comme autant *d'origines ou des germes* dispersées de cette grande paire des nerfs sympathetiques, et par consequent comme autant des *petits cerveaux*."

2d, As the heart continues to contract in cases of perfect apoplexy, much longer than the muscles under the immediate dominion of the will.

I shall not enter more at large into the theories which have been proposed respecting the use of the ganglia *; a subject which, like the functions of the nervous system, is still involved in an obscurity, which the observations and experiments of modern anatomists have not hitherto dissipated.

The last observation I shall make respecting the course of the nerves, is, that we cannot from connection of nerves explain the regular movements

* The reader who wishes for further information respecting the Ganglia, is referred to the following Authors:

Vieussen's Neurol. Univ. p. 160.

Willis, Cerebri Anat.

Winslow, Traité d'Anat. complet.

Barthez, Nouveaux Elemens de l'Homme, tom. ii. p. 62.

Monro's Observations on the Nervous System.

Walter, Etvas über die Hirnschadellehre, th. i. s. 18.

Haase, Cerebri Nervorumque Corp. Hum. Anat. repet. Lipsiæ 1781.

Bichat, Anat. General, tom. i.

Reil, Archiv. fur Phys. B. 7. st. 2. s. 219.

Scarpa, de Nervor. Gangl. et Plexib. Mutin. 1779.

Pfeffringer de Struc. Nerv. Argent. 1782.

Anat. et Physiol. du Syst. Nerv. en general, et du Cerveau en particulier, par Gall et Spurzein.

of our different organs, which are occasioned by stimuli.

This proposition is obvious from the following circumstances:

1. Muscles, supplied by the nerves irritated, often do not act, but others at a distance. Thus, when the outside of the fore-arm is burnt, not the extensors, but the flexors of the fore-arm act, and remove it from the offending cause.

2. Muscles most connected by their nerves do not sympathise most.

3. Sympathy is not to be traced the reverse way.

4. Muscles supplied by intermediate nerves are at rest.

5. The same nerve irritated in different parts produces different motions.

6. The same nerve, gently and violently irritated, produces different motions.

7. The same nerve, accustomed to the stimulus, acts less, or not at all.

8. Antagonist muscles receives nerves from the same roots.

9. There are many sympathies, where a connection of nerves is not to be traced.

10. Many impulses affect the mind first.

11. Affections of the mind, without the presence of external objects, produce the same effects *.

* As the late ingenious Dr WHYTT, in 1765, published a treatise on the sympathy and diseases of the nerves, in which

Upon the whole, it appears; 1. That the actions above mentioned cannot be accounted for on the yet well-known principles of mechanism.

2. We observe that the muscular fibre varies its operation according to the purpose to be served. That, for instance, when a muscular fibre is punctured, it vibrates, which is the fittest means of throwing off the offending cause; that the alimentary canal, acted on gently by the food, performs a very complex peristaltic motion; that the abdominal muscles act slowly and steadily in expelling the contents of the rectum, but suddenly and convulsively in vomiting; that the bladder of urine, from which there is a small outlet, performs a slow and uniform contraction in discharging its contents, whilst the heart contracts with a jerk.

3. The more we consider the various spontaneous operations, the more fully we shall be convinced that they are the best calculated for the preservation and well-being of the animal *.

many of the above arguments against the then common accounts of the cause of the sympathy of nerves are mentioned, I think it necessary to observe, that I had delivered all the above arguments in my course of lectures eight years before Dr WHYTT printed on that subject, and three years before he wrote and delivered lectures upon it."

* Vid. MONRO's Nervous System, p. 100. & 101.

PART XXIII.

CHAPTER I.

OF THE ORGANIC DERANGEMENTS OF THE SPINAL MARROW.

As the Spinal Marrow and Brain are of a similar structure, the organic derangements of these organs are very analogous.

On account of the remarkable degree of sympathy and connection betwixt the spinal marrow and brain, diseases originating in the spinal marrow, may be propagated to the brain, or *vice versa.*

The spinal marrow may suffer, not only from violence directly applied, but also from a shock communicated to it, as by falling on the breech, knees, or even on the feet.

A violent blow upon the spinal marrow, produces very different effects, according to the part which is more immediately injured.

A blow upon the neck, sometimes renders the arms paralytic. If the violence is inflicted on the loins, the bladder of urine, rectum, and inferior extremities, and other parts upon which the nerves

of the lower part of the spinal marrow are distributed, become paralytic, which is often followed by a suppression of urine, numbness, and shrinking of the thigh.

The spinal marrow may, like the brain, be much injured by the pressure of extravasated blood, or by any other cause which diminishes the diameter of the spinal canal, as by inflammation of the dura mater lining it, by exostoses, curvature of the spine, by fractures, or dislocations of the vertebræ.

The spinal marrow sometimes becomes very hard, having a cartilaginous consistence, and the investing membranes of that place become very red and inflamed.

Scrofulous tubercles grow from the spinal marrow.

Dropsy may also be enumerated among the diseases of the sheath of the spinal marrow.

The dropsy of the spinal marrow is frequently complicated with hydrocephalus, and sometimes with an imperfection of the spinal processes of the vertebræ. In the latter case, there is sometimes a free communication between the spinal marrow and the head; hence the tumour in the back becomes larger when the head is erect, but smaller considerably upon placing the head lower than the rest of the body.

CHAPTER II.

OF THE ORGANIC DERANGEMENTS OF THE NERVES.

We are still much in the dark as to many of the organic derangements of the nerves.

There are many diseases which seem to be connected with some derangements of the nerves, upon the nature of which dissection throws no light, there being no visible derangement in any part of the nervous system.

A nerve, when punctured, sometimes swells considerably, and for some extent; as when the cutaneous nerve of the arm has been injured during venesection; but in other cases, the swelling is circumscribed, and limited to a small part of a nerve; thus a very evident tumour may be observed, connected with the extremity of the sciatic nerve, after an amputation of the thigh.

There is another and more rare kind of tumour of a nerve, which is attended by the most excruciating pain. This tumour is occasionally slow in

its growth, but at times increases rapidly. Such tumours have distinct cysts, and they contain blood; and when divided, seem to be composed of a very thick viscid jelly, in which there are a few whiter fibres, which seem to be the continuation of the nervous fibres of the opposite extremities of the tumour.

I examined with care a tumour of this description, which was connected with the radial nerve of a lady, and caused such acute pain, not only in the tumour, but also through the whole member, that she readily submitted to its removal.

The sore healed in about a month, when the tumour returned, and increased rapidly to a great size, from which a fungus grew out. The arm, therefore, was amputated.

Two years afterwards, a tumour appeared over the left eye. On opening the head after the patient's death, the brain was found in a fungus state.

The nerves sometimes shrink; as when we lose the sight of one of the eyes, the optic nerve of that eye becomes evidently smaller than that of the other.

It may not be improper to add, that the nerves which have been cut through, if kept in contact, are frequently reunited by real nervous matter, as has been proved by the experiments of ARNEMAN, CRUICKSHANK *, FONTANA †, MEYER ‡, and

* Phil. Trans. 1795. p. 177.

† Sur la Venin. de la Vispere, vol. ii.

‡ Bibliotheq. Germanique.

DR HAIGHTON *. MEYER, taking advantage of the observations of Professor REIL †, that the nitric acid dissolves the coats and cellular substance of the nerves, but not their medullary matter, distinctly proved that the nerves are rejoined by real nervous matter. He divided the left sciatic nerve of an animal; the wound healed in a short time, and the animal regained the sensibility and power of moving its limb. Upon dissection, the divided nerve was immersed in the nitric acid, and was found reunited by real nervous matter.

The nerves have also been said to inflame violently; which inflammation is succeeded by suppuration.

SOEMMERING has made mention of what he calls *Corruptio Nervi*. "Corruptus nervus gracilior fit, brevior, firmior, simul atque durior, semiperlucidus, cartilaginis in modum, coloremque cinereum induit. Corrupto nervo pars, quam adit, usui publico non amplius inservit ‡."

* Phil. Trans. 1795, p. 190.

† Exercit. Anat. de Struct. Nervi.

‡ Vid. vol. IV. of his book, De Corporis Humani Fabrica.

PART XXIV.

CHAPTER I.

OF THE STATE OF THE OVARIA, UTERINE TUBES, AND UTERUS AT THE NINTH MONTH OF PREGNANCY.

SECT. I.

OF THE STATE OF THE OVARIA.

In a former Chapter, it was observed that the rudiment of the fœtus is derived from the ovarium, which in consequence of impregnation, differs materially from that of the virgin.

A small rounded or oval-shaped body may be observed to project from some part of its surface; which, being somewhat of a brown or straw colour, has been named *corpus luteum*.

Upon dividing the corpus luteum, it is found to be very tender; of a pale straw colour, particularly towards its centre, where it is somewhat transparent; in its circumference, irregular, and

encircled by bloodvessels, which shoot inwards towards the centre.

In the case of twins, a corpus luteum is found in each ovarium, or two corpora lutea in one of the ovaria; and in quadrupeds, the number of the young always corresponds with the number of the corpora lutea.

Sect. II.

OF THE STATE OF THE UTERINE TUBES AT THE NINTH MONTH.

The uterine tubes do not pass horizontally outwards as in the virgin state, but are closely applied to the uterus; are also larger, redder, less convoluted; exhibit more distinctly a muscular structure; and the internal rugæ are more distinct.

Sect. III.

OF THE STATE OF THE LIGAMENTS OF THE WOMB AT THE NINTH MONTH.

In consequence of the extension of the womb, the broad ligament in a great measure disappears, for little more than its root remains.

The round ligaments pass downwards on the fore-part of the body of the uterus, and are considerably larger and more vascular than in the virgin state.

SECT. IV.

OF THE STATE OF THE WOMB AT THE NINTH MONTH.

THE substance of the womb is unlike any other part of the animal body; it is soft, loose in its texture; plastic, and readily impressed by any harder body with which it comes into contact.

This laxity of texture seems to be connected with the large quantity of cellular substance, and the number and size of the bloodvessels and lymphatics which are proper to it. The greater part of the substance of the uterus is composed of small muscular fibres, the course of which it is impossible to trace upon the outer surface of the womb, and these possess the distinguishing property of the muscular fibre a contractile power, which, according to Dr HUNTER, is in some parts of the womb voluntary, but in others involuntary; and in some places slow, but in others quick. Owing to the softness of the muscular structure of the womb, which is not put upon the stretch by the contained parts, the womb very readily changes its shape from a particular posture, the pressure of

adjacent parts, or from the position of the fœtus.

The mouth of the pregnant womb is widely different in appearance from that of the unimpregnated womb. At the ninth month it is flat ; and there are a number of cavities on its inner side, containing a viscid jelly, which plugs up completely the mouth of the uterus. When delivery has commenced, this jelly is detached, and by extending the mouth of the womb, facilitates labour.

This viscid gluten is discharged along with the liquor amnii, and exhibits a distinct cast of the lacunæ of the orifice of the uterus, within which it had been lodged.

The arteries of the uterus at the ninth month are very large and numerous, and freely communicate with each other, and upon the inner side of the womb are remarkably tortuous.

The veins of the womb follow the same course as the arteries ; are considerably larger than the arteries ; and, on account of their great size, have been named by some anatomists, *venous sinuses*.

The lymphatic vessels of the uterus increase as much as the bloodvessels of that organ in consequence of pregnancy, and are about the size of a common writing-pen ; very numerous, and form a plexus over the greater part of the substance of the womb.

Sect. V.

OF THE POSITION OF THE GRAVID UTERUS.

The gravid uterus displaces and pushes upwards the intestines and omentum, and is in immediate contact with the parietes of the abdomen.

The gravid womb is placed obliquely; and with the small or lower end, directed downwards and backwards, towards the ossa coccygis; and its fundus, or upper and larger part, is turned forwards. Such is the general position of the womb; but there is some difference as to the position of the womb even in the same individual in different pregnancies.

In a first pregnancy, the parietes of the abdomen oppose a greater resistance to the extension of the womb, the axis of which is thereby placed more in a vertical direction; whereas the abdominal parietes of a woman who has had several children, being more loose or relaxed, the belly becomes more prominent and pendulous, and the uterus does not ascend so high within the cavity of the abdomen. The position of the womb is also regulated in some measure by the stature of the woman, and by the width of the pelvis. The uterus of very short women, on account of the smaller distance which intervenes between the pel-

vis and abdomen, is placed more transversely than that of a taller woman; and when the pelvis is small or distorted, it is capable of containing only a small portion of the gravid uterus.

The gravid womb also commonly inclines more to one side than the other, especially in women who have borne several children, which gives rise to weakness, numbness, pain, cramps, œdema, or varicose veins of the limb of the same side.

Sect. VI.

OF THE MEMBRANES OR SECUNDINES AT THE NINTH MONTH.

The placenta and membranes form a complete bag, which contains the fœtus and liquor amnii.

At the ninth month, we meet with three membranes only; the amnion, chorion, and decidua.

The membrane next the fœtus, called *amnion*, is very thin and pellucid; but in texture firm, and not readily torn. It lines the placenta; is reflected on the umbilical cord, and terminates at the navel; and is united to the chorion by means of a gelatinous substance.

The membrane on the outer side of the amnion, called *chorion*, is thicker than the amnion in some places, nearly transparent, and, in the earlier sta-

ges, exhibits a flocculent appearance, being covered by a number of small vessels.

The third membrane lines the uterus, and falls off at every delivery; and has hence been called *decidua*. It is very easily torn, though thicker than the amnion or chorion; and there are a number of small vessels proper to it, which contain red blood.

SECT. VII.

OF THE LIQUOR AMNII.

THE fluid contained within the amnion, has been called *liquor amnii*.

This fluid, which varies in quantity in different women, has no sensible degree of tenacity; is nearly transparent; has a slight yellow tint; and sometimes reddish, from an admixture of a few drops of blood; is to the taste salt, and is composed of

Water, about - - -	98.8
Albumen; muriate of soda; soda; phosphate of lime; lime, - -	1.2
	100.0

In some cases, there is a small quantity of water between the chorion and amnion, which is commonly discharged before the birth of the child.

SECT. VIII.

OF THE NAVEL-STRING OR UMBILICAL CORD.

THE umbilical cord, the medium of connection between the placenta and child, is not uniform as to thickness and length.

It is generally thinnest near to the placenta, and about two feet long; but in some cases does not exceed a foot, and in others is four or five feet long; and sometimes makes two or three turns round the child's neck. The umbilical cord consists of two arteries and a vein, and a thick jelly, which are enveloped by the chorion and amnion.

The arteries and vein of the cord are disposed in a spiral direction. In some very rare instances there is only one artery.

In some cases, the umbilical arteries are not disposed in the usual manner, but are for some way straight, and then form a sort of knot, one of the arteries being longer than the other.

Owing to the thick jelly which envelopes the arteries aud vein of the umbilical cord, and the spiral course of its arteries, pressure, or the stretching of the navel-string does not readily interrupt the flow of blood through its bloodvessels.

SECT. IX.

OF THE PLACENTA OR AFTER-BIRTH.

THE placenta is a flat organ; to the touch spongy; in form nearly circular; and about an inch in thickness in its centre, when its vessels are distended.

The placenta becomes gradually thinner towards its circumference; and, when fixed to the uterus, is concave next the child, and convex towards the womb. The surface of the placenta, which is attached to the womb, is very tender, and lobulated.

The umbilical cord is not attached exactly to the centre of the placenta, but rather nearer to its edge; and from the umbilical cord, the vessels spread out upon the surface of the placenta, from which they pass into its substance.

The placenta is generally fixed to the fundus uteri.

The large umbilical bloodvessels are disposed on that part of the placenta which is next the child; and on the side next the uterus, bloodvessels may be observed passing between the placenta and uterus.

The placenta, when divided, seems to be composed chiefly of bloodvessels, which are distributed through it in all directions.

By filling the vessels of the placenta, it becomes about two inches thick; and if the injection be thrown into the arteries of the mother, called *uterine*, the injection fills only one-half of the placenta, as that organ *consists of two distinct parts*, which do not communicate with each other, and between which are cells that are filled by throwing a penetrating injection into the arteries or veins of the uterus.

These fœtal and maternal parts of the placenta may be separated from each other, by steeping it for some time in water, until a slight degree of putrefaction has begun.

The structure of these distinct parts is not precisely the same; the portion called *fœtal* bears a strong resemblance to the lungs, and the arteries of that part terminate in the veins; but in the *maternal part* cells are interposed between the smaller ramifications of the arteries and veins, and the cells of the whole placenta freely communicate with each other.

CHAPTER II.

OF THE STATE OF THE WOMB IN THE EARLIER MONTHS OF PREGNANCY.

About the end of the third month, the ovum may be distinctly seen within the womb.

The ovum consists of the membranes which contain the fœtus and liquor amnii.

There are four membranes in the earlier months, the *amnion*, *chorion*, *decidua*, and *decidua reflexa*.

A part of the decidua is reflected, forming the fourth covering. Dr Hunter has particularly described this reflection *.

* "It is a membrane of considerable thickness, and is sometimes of a yellower colour than the decidua vera †. The ovum lies between a part of the decidua reflexa, both of which unite into one membrane at the edge of the placenta; or the decidua vera divides itself at the edge of the placenta into two laminæ,

† If it did not lead to some risk of producing an erroneous opinion with regard to the formation of the decidua, I think it would be better to call the decidua vera, by the name of the *decidua uteri*; and the decidua reflexa, by the name of the *decidua chorii*. This would render it more easy, to acquire a clear idea of the whole membranes.

The chorion is considerably thicker in the earlier than in the more advanced stages of pregnancy, and is covered by flocculi of different lengths and thickness, which in a short time disappear, excepting in the upper part, where they contribute to form the placenta.

one of which passes between the placenta and the inner surface of the uterus, and the other forms the decidua reflexa, which covers the outer surface of the chorion. The decidua enveloping the ovum, does not, however, merely cover the shaggy vessels of the chorion at their outward floating extremities, but also the whole of their external surface, as deep as the chorion.

" The chorion itself commonly appears transparent, and not covered by any layer of decidua immediately applied to it. It sometimes, however, although I believe very rarely, appears to be distinctly covered with a thin layer of decidua; and, therefore, in those cases where it seems to be wanting, it may not improbably be supposed to be so very thin as to escape observation.

" What is now said, however, is to be considered as merely conjectural.

" Where the decidua reflexa is beginning to pass over the chorion, there is, at an early period of pregnancy, an angle formed between it and the decidua, which lines the uterus; and here the decidua is often extremely thin, and perforated with small openings, so as to look like a piece of lace. In proportion as pregnancy advances, the decidua reflexa becomes gradually thinner and thinner, so that, at the fourth month, it forms an extremely fine layer covering the chorion.

" It comes at the same time more closely in contact with the decidua, which lines that part of the uterus to which the placenta is not fixed, till at length they adhere together *."

* See Dr Hunter's Anatomical Description of the Human Gravid Uterus and its contents; published by Dr Baillie, p. 80. & 81.

Between the chorion and amnion, which cover the umbilical cord, there is a bag of an oval form, filled by a fluid called *vesicula alba*.

The quantity of the liquor amnii, is proportionally greater in the first than in the latter months of pregnancy.

In the earlier months, the umbilical cord is very short; at the period of birth it is commonly about two feet long.

The *urachus* constitutes a part of the umbilical cord: it consists of thin fibres which ascend from the fundus of the bladder, and which are inserted into the navel-string.

The uterus rapidly attains an unusual size, in consequence of the determination of blood to it.

The difference in the size of the uterus, is considerable in different women; it depends on the size and number of the fœtuses, and also on the quantity of liquor amnii.

The uterus does not rise so much, as to be sensibly felt above the ossa pubis, till after the fourth month of pregnancy.

The fundus uteri is in the first place distended, and then the neck of the uterus almost disappears.

The mouth of the pregnant uterus is directed backwards, so that the axis of the uterus corresponds with that of the pelvis.

At the fourth month, the womb measures about five inches from the fundus to the beginning of its neck.

At the sixth month, it extends about four inches above the pubis.

At the eighth month, the uterus reaches half way between the navel and sternum; and, at the ninth month, it reaches as far up as the ensiform cartilage of the sternum.

The above measurements are not mathematically correct; they vary a little, from the differences in the stature of different women, the size of the fœtus, and the quantity of liquor amnii.

CHAPTER III.

OF THE STATE OF THE FOETUS IN THE EARLIER MONTHS OF PREGNANCY.

It has not yet been ascertained at what period the fœtus is visible, and at what time the ovum reaches the womb.

It is most probable that the ovum does not reach the womb until three or four weeks after conception.

The ovum at first does not contain a visible fœtus.

The human fœtus has been described as being a line in length when first perceptible.

By the seventh week, the fœtus has been stated to be equal to a bee in size; and, about the eighth week, to be as long as a kidney-bean, and in form to resemble two ovals of unequal size, joined by a neck.

Baron HALLER, has bestowed great pains in order to discover the growth of the fœtus in utero.

He has stated, that it increases during the first month to a bulk 300,000 times greater than its original size; during the second month, the increase is forty-eight times the size it had at the end of the first; from which time, to the ninth month, there is at an average an increase of fifteen times for each month.

The younger the fœtus, the larger the ovum is, and the greater the proportion of the head to the trunk. Still the fœtus does not increase in size in proportion to its age.

In the second month, it has been said to grow more slowly, in the third more quickly, in the fourth more slowly; but from the middle of the fourth month to the sixth it grows more rapidly; and between the sixth and ninth month, more slowly.

The embryo in the first and second month, is a little bended. In the fourth and fifth, from the addition of its extremities, it seems folded up.

After the second month, the head grows more slowly. The face, in a small fœtus, bears a small proportion to the brain-case.

The fœtus at first seems to have no neck.

The eyes appear at first like black circles: before the third month, the eye-lids are either open, or so thin, that the eye-ball shines through them.

There are little pores in the situation of each ear about the ninth week: and the external ears are not complete until the fifth month.

About the eighth week the nose appears.

Two small apertures may be observed at first, and it is complete about the twelfth week.

The mouth is large at first, and is visible about the seventh week, but not the lips; they begin to be formed about the tenth week, and at the twelfth, are quite distinct.

The organs of generation are manifest at the fourth month.

In the fourth month, the fœtus is about five inches long.

In the fifth month, the fœtus is about six or seven inches in length.

In the sixth month, the fœtus is eight or nine inches long, and perfect in its shape and formation.

In the seventh month, it is eleven inches.

About the sixth week, the limbs begin to grow and appear like little buds. In the second month, they are a little elongated; and about the begin-

ning of the third month, or a little after, the fingers and toes are formed.

Professor SOEMMERING has remarked, even in the fœtus between the third and fourth month, the greatest difference in the thorax of the sexes, That the male is not only longer and more conical, but much more prominent in respect to the abdomen and pelvis, than the female.

The female chest is not only shorter, but also wider above the fourth rib; below, it is more contracted, and therefore less conical; and it is also farther distant from the pelvis, as a greater space intervenes between the last rib, and spine of the os ilium.

He observes, That there is also a difference in the form of the head; the head of the male is larger, but less rounded; the occiput, besides, is a little raised.

On the other hand, the head of the female is smaller, and more rounded. The occiput is scarcely raised. He also observes, That the arms of the male are a little longer than those of the female; and the scapulæ are larger and more prominent.

The inferior extremities of the male, according to SOEMMERING, are more contracted, being adapted to the narrow pelvis, and the thighs are more slender.

At the full time, the fœtus is about twenty-two inches long, and weighs from six to eight pounds.

Till the sixth week, the belly of the fœtus is in contact with the placenta.

About the eighth week, the umbilical cord is nearly an inch long.

CHAPTER IV.

OF THE FOETUS IN UTERO IN THE NINTH MONTH OF PREGNANCY.

Sect. I.

OF THE POSITION OF THE FOETUS IN UTERO.

The fœtus is laid in such a manner within the womb, as to occupy as little space as possible.

The body is of an oval form, the head constituting the one extremity of the oval, and the breech the other; and the long axis measures about ten inches, the shorter between five and six. Dr William Harvey has given the following very beautiful and accurate description of the position of the fœtus in utero. " Ideoque in-

fans in utero ut plurimum reperitur, adductis ad abdomen genibus, flexis restrorsum cruribus, pedibus decussatis, manibusque sursum ad caput sublatis, quarum alteram circa tempora vel auriculas, alteram ad genam detinet; ubi maculæ albæ, tanquam confricationis vestigia, in cute cernuntur: spina in orbem flectitur, caput ad genua, incurvato collo, propendet. Tali membrorum situ, qualem in somno per quietem quærimus, capite superne, facieque ut plurimum ad matris spinam versa, embryo locatur *."

SECT. II.

OF THE PECULIARITIES AS TO STRUCTURE OF THE FOETUS.

THE skin of the fœtus is besmeared by a white greasy substance, which is insoluble in alcohol, oil, or pure water, and forms a soap with alkalies.

The skin is redder than that of the adult; and though there be a good deal of fat under the skin, there is very little fat between the muscles, or within the cavity of the abdomen.

The most striking peculiarities of the fœtus, are, the imperfect state of its bones, the large size of all its glands, and of the nervous and vascular systems.

* Vid. G. HARVEII Opera, vol. ii. p. 241.—4to.

The bones of the fœtus contain a much larger proportion of animal matter, than those of the adult, are of a grey colour, and the extremities of the long bones have a red tinge, from the number of bloodvessels proper to them.

All the bones of the fœtus are nearly uniform on their surfaces; whereas those of the adult, are very irregularly and deeply imprinted by the muscles.

The bones of the fœtus are filled by jelly instead of marrow.

The bones of the fœtus are imperfect, and the greater number of them consists of several pieces; in each of which, there is a centre of ossification *, from which fibres issue in different directions.

The ossification does not go on with equal rapidity in all the bones.

The ossification begins in the first place in the clavicles, ribs, vertebræ, and cylindrical bones, and then in the bones of the face and cranium.

Each of the long bones consists of a middle shaft, an upper and under piece, which are not united to the middle piece until the period of puberty, and in each there is a centre of ossification.

The ossification takes place in the flat bones from centres of ossification, and advances to the circumference of the bones.

* Vid. ALBINUS, on the Bones of Children, and NISBET's Osteology.

The younger the embryo, the greater the proportion of the head to the rest of the body.

The bones of the fœtal cranium are united by membranes instead of sutures.

The anterior and uppermost parts of the pieces composing the frontal bone, and the anterior and superior portions of the parietal bones, are unossified at the period of birth: so that a quadrangular portion of the brain is covered by membrane only; and as a heaving is perceived at that place, it has been called *fons pulsatilis*, or *bregma*; and the word *anterior* is added to distinguish it from an unossified portion at the back-part of the head, of a triangular form, situated where the sagittal and lambdoidal sutures are united; this last has been called the *posterior bregma*.

There is likewise an unossified portion at the fore and also at the back-part of the pars squamosa of the temporal bone.

The bones of the cranium of the fœtus, bear a large proportion to those of the face, which are small, owing to the want of the sinuses and the teeth.

The cavity of the thorax, is proportionally larger than in the adult; and, according to Professor SOEMMERING, is differently formed even at birth.

The pelvis is proportionally smaller in the child at birth, and its shape is very different; the distance between the ossa pubis and os sacrum, being greater than from side to side.

Lastly, The ossification is generally sooner complete in the superior than in the inferior extremities of the fœtus.

Of the Brain, Organs of the Senses, and Nerves of the Fœtus in Utero.

The brain of the child is proportionally larger and softer than that of the adult.

The olfactory nerves are hollow.

Of the Peculiarities of the eye of the Fœtus.

The eye of the child at birth, differs materially from that of the adult.

The cornea is thicker, more readily divided into layers, and rather more prominent.

All the humours of the eye are less pellucid than in the adult.

The aqueous humour is turbid.

The pigmentum nigrum of the choroid coat is less fluid.

Before birth, the pupil is obstructed by a membrane, called *membrana pupillaris.*

The crystalline lens is of a spherical form, and the bloodvessels of the back-part of the capsule of the lens, admit the red globules of the blood.

Of the Peculiarities of the Ear of the Fœtus.

The ear of the fœtus differs from that of the adult, in many respects.

The meatus auditorius externus, is entirely cartilaginous; and the membrane of the drum, which is not so tense as in the adult, and more on a level with the side of the head, is fixed to a circle of bone. There are no mastoid processes in a child at birth, and the Eustachian tube is in part membranous.

There is but little difference in the structure of the internal parts of the ear of the fœtus and adult.

The chain of bones in the fœtus is proportionally larger. The cochlea and semicircular canals are also proportionally larger in the fœtus, and the membranous canals included within the semicircular canals, are more easily distinguished than in the adult *.

Of the Thoracic Viscera of the Fœtus.

The thoracic viscera of the fœtus, are very different from those of the adult. The gland, called

* Vid. Scarpæ Disquisit. Anat. de Auditu et Olfactu. Ticini, 1789.

thymus, lodged in the anterior mediastinum, is of considerable bulk and length in the fœtus, and divides at its lower part into two lobes, and the substance of it is soft, and exhibits somewhat of a lobulated appearance; and when cut, a whitish liquor may be squeezed out from it.

The bloodvessels of this gland are derived from the subclavian, vertebral, thyroid, and diaphragmatic arteries.

The heart of the fœtus is very different from that of the adult in many respects; it is of a conical form, and proportionally larger, and in a very young embryo seems to fill the greater part of the thorax.

There is a passage of communication between the anterior and posterior auricles, called the *foramen ovale*; the size of which, is very different in fœtuses of different ages.

This passage between the auricles, is by no means direct; it is oblique, and in figure somewhat resembles a crescent; and the valve of the foramen ovale is formed by a fold of the lining of the auricle, and its loose edge is turned towards the left auricle.

The blood from the right auricle readily opens this valve, but cannot flow back into the right auricle, for the refluent blood shuts the valve.

The valve, called the *Eustachian*, situated at the mouth of the vena cava inferior, is more perfect and larger in the fœtus, than in the adult.

The lungs of the fœtus in utero, are small, dense, and firm, and bear a strong resemblance to the liver in colour and consistence, and sink in water.

Their specific weight is to that of water, as 22 to 21.

Of the Mammæ of the Fœtus.

The mammæ are large in proportion to the size of the body of the fœtus, and contain a fluid, which may be pressed out from them.

Of the Abdomen and its Contents.

The abdomen of the fœtus is conical towards the navel, proportionally larger, and also more prominent than that of the adult.

The diaphragm of the fœtus is much less concave towards the abdomen; and hence the liver descends in the fœtus, lower than the edge of the thorax.

The stomach is more rounded, and its length is proportionally greater than in the adult.

The larger omentum connected with the greater curvature of the stomach, is placed more on the left side, and there is a much smaller quantity of fat connected with it.

The intestines, which have been described as being redder and proportionally longer than in the adult, are not provided with such large valvulæ conniventes, and contain more or less of a soft substance, of a dark green colour, called the *meconium.*

The ligaments of the larger intestines are less apparent than in the adult, consequently the cells of these intestines are proportionally smaller.

The appendix vermiformis, is at the bottom of the caput cæcum coli, not at the side of it, as in the adult.

Of the Assistant Chylopoëtic Viscera.

The liver of the child occupies a considerable share of the cavity of the abdomen, and is more equally divided into a right and left lobe, than in the adult.

The umbilical vein passes from the navel in a duplicature of peritoneum, to the left branch of the vena portæ, and a *venous canal* passes between the left branch of the vena portæ and the vena cava inferior, called *canalis venosus.*

The gall-bladder is filled by a green fluid, which, a short time before birth, becomes much darker in colour, and has been described as having a bitter taste.

The pancreas is also of a large size in the fœtus.

Of the Organs of Urine and Generation of the Fœtus.

The kidneys of the fœtus consist of distinct lobes. The renal glands are almost as large as the kidneys, somewhat triangular in form, flattened, and are largely supplied with blood from the diaphragmatic, renal, and lumbar arteries. The corresponding veins terminate in the renal veins, or in the vena cava inferior.

The pelvis of the fœtus is proportionally much smaller than that of the adult; and hence the bladder of urine, in a very young fœtus, may be enumerated rather among the bowels of the abdomen, than among those of the pelvis.

The bladder of urine of the fœtus is more of a conical form, and the urethra takes its rise nearer to the lowest part of the bladder than in the adult.

The fundus uteri and Fallopian tubes, are also placed much higher than in the adult.

The uterus of the fœtus, is of a prismatic form, and proportionally longer than in the adult.

The testes of the male, and the ovaria of the female, are lodged originally in the cavity of the abdomen, below the kidneys on the psoæ muscles, to which they are connected by the peritoneum. The shape and figure of the testis, when within

the abdomen, are much the same as within the scrotum.

The epididymis is placed along the posterior edge of the testis, and is larger in proportion than in the adult.

The younger the fœtus, the slighter the connection of the testes to the psoæ muscles.

The spermatic arteries take their rise from the aorta, a little below the renal arteries. The testes also receive their blood by branches of the hypogastric artery, which ascend and pass close to the vas deferens.

The veins of the testes are similar to those of the adult.

The testes are connected by a ligament, which extends between the lower end of the testis and scrotum, which Mr J. HUNTER calls *gubernaculum*, which he has thus described: "It is of a pyramidal form, its large bulbous head upwards, and fixed at the lower end of the testis and epididymis, and its lower and slender extremity is ost in the cellular membrane of the scrotum *."

This ligament, or gubernaculum, is fibrous, and provided with bloodvessels.

The testes generally descend about the eighth month into the scrotum, but, in some cases, stick in the groin.

The passage through which the testes had passed, remains open in some cases.

* Vid. Observations on certain parts of the Animal Economy, page 6.

It may not be improper to add, with respect to the organs of generation, that the prepuce of the penis is proportionally longer, and that of the female clitoris, is larger, in the fœtus than in the adult, which has sometimes led to mistakes respecting the sex of the infant.

The extremities of the fœtus are, in proportion to its head and trunk, smaller in proportion than in the adult.

CHAPTER V.

SECT. I.

OBSERVATIONS UPON THE OVARIA.

It has been already remarked, that the rudiment of the fœtus is derived from the ovarium; but it is not certain whether a fluid or a solid substance, shaped like an egg, be formed within the ovarium, nor do we know at what period in women * that

* Vid. the Experiments of Mr CRUICKSHANK on Rabbits, read before the Royal Society of London, March 23. 1797.

which is essential to impregnation passes into the womb.

Sect. II.

OF THE MANNER IN WHICH THE BLOOD OF THE FOETUS IS CIRCULATED.

The economy of the fœtus is very different from that of the adult.

The functions of circulation and respiration have in the full grown person a mutual relation and dependence upon each other. The circulation of the blood of the fœtus in utero is adapted to the state of the lungs; the fœtus does not breathe, and a very small portion of blood passes through these: It is diverted from the lungs by the foramen ovale and canalis arteriosus.

The fœtus is attached to the mother by means of the navel-string, and placenta.

The navel-string is composed of two arteries and a vein, which, with a quantity of jelly, are inclosed by the membranes, called *chorion* and *amnion;* and the flow of blood through these arteries of the navel-string cannot readily be interrupted either by pressure, or by stretching of the cord.

By means of the umbilical vein, which takes its rise from the interior part of the placenta, by many branches, the blood is returned to the body

of the child. This vein enters at the navel of the child; ascends in a fold of the peritoneum behind the recti muscles, to the anterior extremity of the fossa umbilicalis of the liver; it passes along half that fissure; gives branches to both lobes of the liver, and terminates in the left branch of the vena portarum, from which a part of its contents flows into the vena cava inferior by the canalis venosus.

The blood of the vena cava inferior, which divides into two branches, flows into both auricles.

The greater share of it passes into the left auricle, through the foramen ovale by the medium of the larger branch of the inferior vena cava.

From the left auricle, the blood flows into the left ventricle; and by the muscular contraction of that organ, it is propelled into the aorta and its several branches.

It has been already observed, that, on account of the peculiar state of the lungs of the fœtus, there were two direct passages, by which the blood is diverted from the lungs. If there had existed only one passage, the auricles and ventricles of the right and left sides of the heart must have transmitted unequal quantities of blood. If the foramen ovale had been awanting, the right side of the heart must have received the whole of the blood, and the left side of the heart only that smaller proportion of the blood which had passed

through the lungs; whereas supposing the foramen ovale, canalis arteriosus and pulmonary artery to have transmitted equal quantities of the blood, the same proportion of blood passes in the same time through both auricles and ventricles of the heart; the purpose of which is obvious, as after birth they are intended to transmit equal quantities of blood.

Hence, too, in consequence of the existence of two passages, both auricles and both ventricles receive blood, which has passed through the system of the mother, and has undergone the necessary changes.

There is considerable difficulty in explaining, why the umbilical vein is connected with the vena portarum, and not directly with the vena cava, and also why the canalis venosus is of smaller diameter than the umbilical vein, and does not correspond with both umbilical arteries.

The umbilical vein probably is connected to the vena portarum, in order that its contents may be more equally divided between the two principal veins, the vena cava and vena portarum. If the whole of the blood had gone to the vena portarum, the liver could not well have transmitted it; and if the whole had gone to the vena cava, the liver would not have been prepared for the increased quantity of blood passing into the cœliac and mesenteric arteries, when a ligature is thrown around the umbilical arteries after birth. Another reason may be, that the umbilical vein pro-

bably conveys to the fœtus the blood, or part of the blood, from the aorta of the mother, which has undergone a great change by passing through her lungs, and which may have the same effect on the liver, which the blood of the hepatic artery has after birth.

After delivery, the foramen ovale and canalis arteriosus are commonly shut, for which it is difficult to assign a satisfactory reason.

SECT. III.

OBSERVATIONS ON THE LUNGS OF THE FOETUS.

THE lungs of the fœtus resemble the liver of the adult in consistence, and sink in water. But though the lungs do not sink in water, it is not certain that a child has been born alive, and had breathed, as air may have gotten into the lungs during the taking them out from the body, or may perhaps be generated by putrefaction, or may have been designedly thrown into the lungs.

Dr WILLIAM HUNTER, in a paper in the sixth volume of his London Medical Observations and Inquiries, which does no less honour to his heart than to his head, has explained at great length the uncertainty of the signs of murder in the case of concealed labour; from which very instructive paper the following short extract has been made:

"In suspicious cases, how far may we conclude that the child was born alive, and probably murdered by its mother, if the lungs swim in water?

"First, We may be assured that they contain air. Then we are to find out if that air be generated by putrefaction.

"Secondly, To determine this question, we are to examine the other internal parts, to see if they be emphysematous or contain air; and we must examine the appearance of the air-bubbles in the lungs with particular attention. If the air which is in them be that of respiration, the air-bubbles will hardly be visible to the naked eye; but if the air-bubbles be large, or if they run in lines along the fissures between the component *lobuli* of the lungs, the air is certainly emphysematous, and not air which had been taken in by breathing.

"Thirdly, If the air in the lungs be found to be contained in the natural air-vesicles, and to have the appearance of air received into them by breathing, let us next find out if that air was not perhaps blown into the lungs after the death of the infant. It is so generally known that a child, born apparently dead, may be brought to life by inflating its lungs, that the mother herself, or some other person, might have tried the experiment. It might even have been done with a most diabolical intention of bringing about the condemnation of the mother."

In a subsequent page, he has added: "If in the case of a concealed birth, it be clearly made out that the child had breathed, may we infer that it was murdered? Certainly not. It is certainly a circumstance, like the last, which amounts only to suspicion. To prove this important truth to the satisfaction of the reader, it may be thought fit to assert the following facts, which I know from experience to be true, and which will be confirmed by every person who has been much employed in midwifery.

"1. If a child makes but one gasp, and instantly dies, the lungs will swim in water as readily as if it breathed longer, and had then been strangled.

"2. A child will very commonly breathe as soon as its mouth is born, or protruded from the mother, and in that case may lose its life before its body be born; especially when there happens to be a considerable interval of time between what we may call the birth of the child's head, and the protrusion of its body. And if this may happen where the best assistance is at hand, it is still more likely to happen when there is none; that is, where the woman is delivered by herself.

"3. We frequently see children born, who, from circumstances in their constitution, or in the nature of the labour, are but barely alive; and after breathing a minute or two, or an hour or two, die in spite of all our attention. And why may not

that misfortune happen to a woman who is brought to bed by herself?

"4. Sometimes a child is born so weak, that if it be left to itself, after breathing or sobbing, it might probably die, yet may be roused to life by blowing into its lungs, applying warmth and volatiles, rubbing it, &c. &c. But in the cases which we have been considering, such means of saving life are not to be expected.

"5. When a woman is delivered by herself, a strong child may be born perfectly alive, and die in a very few minutes for want of breath; either by being upon its face in a pool made by the natural discharges, or upon wet clothes; or by the wet things over it collapsing and excluding air, or drawn close to its mouth and nose by the suction of breathing. An unhappy woman, delivered by herself, distracted in her mind, and exhausted in her body, will not have strength or recollection enough to fly instantly to the relief of the child."

SECT. IV.

OF THE NUTRITION OF THE FOETUS.

UPON this subject, there have been very different opinions.

1. The older anatomists were of opinion, that the vessels of the mother and child directly com-

municated with each other by anastomoses, and thus that the child was nourished; but this opinion does not rest upon the solid foundation of induction from fact, because it has been fully ascertained that there is no *immediate communication* between the fœtal and maternal portions of the placenta.

2. The nourishment of the fœtus has been supposed to be absorbed by the veins of the placenta, from the blood effused from the placenta into its cells by the uterine arteries.

3. SCHREGER has proposed a modification of the last-mentioned hypothesis.

He supposes that by the uterine arteries serum is secreted, and discharged into the cells of the placenta, which is absorbed by the lymphatic vessels of the placenta and umbilical cord.

This ingenious theory rests upon an alleged existence of lymphatic vessels in the placenta and umbilical cord; of the existence of which there can be no doubt, as several authors of credit, MECKEL, WALTHERUS, LUDWIG, MASCAGNI, WRISBERG and REUSS, have described them.

4. The fœtus has by some authors been supposed to swallow the liquor amnii, and to derive its nourishment from it.

But as full grown and healthy fœtuses have been born, and with the mouth closed, it follows, that the liquor amnii had not been swallowed; and besides, the liquor amnii is secreted by the ves-

sels of the fœtus itself; as is evident from the analogical fact, that by injecting the vessels of the calf, we fill the vessels of the chorion from which the liquor amnii is derived.

5. It is probable, that the nutrition of the fœtus is primarily or solely conveyed to it by the veins of the umbilical cord, whether we suppose these to be red or lymphatic.

SECT. V.

OBSERVATIONS ON THE FORMATION AND USE OF THE PLACENTA.

THE placenta, which consists of a fœtal and maternal part, is formed by the junction of a portion of the filamentous substance of the chorion, with the plexus of vessels at the fundus uteri. This seems probable, by their being originally no placenta, by the decay of the filamentous substance of the chorion, excepting that part of it which is attached to the fundus uteri, and also from analogy.

In the cow, there are a number of glands on the inner surface of the uterus, from which a milky liquor may be squeezed out; in these, there are excavations, into which the vessels of the chorion insinuate themselves; thus the placentulæ are formed. These placentulæ may readily be sepa-

rated into two parts; between which, there is no communication by a continuity of visible vessels.

The placenta produces upon the blood of the fœtus the same change as the lungs of the adult, and it is also a source of nourishment; for the fœtus cannot be supposed to generate materials for its own nourishment.

SECT. VI.

OBSERVATIONS UPON THE WOMB, AND THE LIQUOR AMNII.

THERE is no part of the human frame, which so rapidly increases in bulk as the gravid womb; and this expansion of the womb is not the mere effect of the distention of its parietes; because these, instead of becoming gradually thinner, as the womb increases in bulk, become progressively thicker. The size of the bloodvessels and lymphatics corresponds with the increased magnitude of the womb.

The great bulk of the gravid womb sufficiently explains many of the symptoms which attend pregnancy, which are merely the effect of pressure; the pregnant womb, for instance, presses upon the bladder, causing frequent calls to make urine: the pregnant womb, pressing upon the

nerves and bloodvessels of the pelvis, occasions cramps, œdema, and varix of the veins of the legs.

Many pregnant women also have occasionally considerable pain in the groins, which is probably owing in part to the stretching of the round ligaments of the womb.

The gravid womb contains a quantity of a watery fluid, named the *liquor amnii*, by which the womb is prevented from pressing unequally upon the body of the child, which expands more equally in all its dimensions.

This watery fluid also renders the pressure of the fœtus on the body of the mother more equal.

The fœtus is expelled from the womb by the combined actions of the abdominal muscles and womb; which latter Dr William Harvey informs us he had seen in a quadruped, and which he has described as a *motus undosus*.

PART XXV.

CHAPTER I.

OF THE MALCONFORMATIONS, AND ORGANIC DERANGEMENTS OF THE FOETUS.

THE limits of these Outlines compel me to reduce my observations on the malconformations and organic derangements of the fœtus within a very narrow compass; a circumstance which I regret the less, as those gentlemen for whose use these Volumes are chiefly designed, enjoy the advantage of having these several subjects discussed in a very able manner, and at great length, by my colleague Dr HAMILTON, Professor of Midwifery.

I propose to enumerate very briefly *, the more frequent, and therefore more important deviations from the natural structure, the consequence either of malconformation or disease; specimens of the

* The reader who wishes to gain very full information on Monsters, should consult LICETUS de Monstris.

greater number of which are contained either in the Museum presented by my Father to the University, or in that belonging to myself.

SECT. I.

OF IMPERFECTIONS IN THE SKELETON OF THE FOETUS.

THERE is no part of the skeleton which is so frequently imperfect as the skull.

The whole upper part of the skull is sometimes awanting *.

I have observed, in different instances, particular spots of the skull unossified, and especially in children born with hydrocephalus.

In a few cases, only the os occipitis is imperfect, and there is a large circular opening in it, through which the membranes of the brain containing water are in some instances protruded, forming a large pendulous tumour from the back-part of the head.

The palatine processes of the superior maxillary bone are frequently disunited, and this is sometimes connected with the imperfect formation of these bones, and with fissure or fissures of

* Vid. MONRO's Nervous System.

the upper lip; and in the case of two fissures, there is sometimes a loss of substance.

The spine of the child is sometimes imperfect, the spinous processes of two or more of the vertebræ being awanting.

This imperfection sometimes exists in the vertebræ of the neck, sometimes in those of the back, but most commonly in those of the loins.

In these circumstances, a soft tumour, of a brown colour, and with an evident fluctuation in it, may be observed over the spine, which commonly bursts in a few weeks, discharges a quantity of a watery fluid, and in a short time afterwards the child dies.

I have examined such tumours, and have observed a number of small nerves distributed over the inner surface of the tumour.

In some cases, the lower end of the spinal marrow is protruded.

Many children are born rickety, and more or less distorted.

The distortion is on many occasions limited to the legs and feet.

Many children are born with the feet and toes turned inwards, or with the malconformation called *club-foot*.

In this case, the deformity is owing chiefly to the too great rotation inwards of the os naviculare upon the astragalus.

Sect. II.

OF MALCONFORMATION OF THE BRAIN AND ORGANS OF THE SENSES.

Many instances have occurred, in which the brain has been imperfectly formed; in these we generally meet with one or two projections of an irregular form.

Three cases of the above kind have been described by my Father in his book, entitled, *Observations on the Nervous System.*

Children, when born, or a few days after birth, are sometimes afflicted by the purulent ophthalmy, which, if neglected, sometimes occasions blindness *.

Children are sometimes born with a cataract in one or both eyes.

One case is on record, of a child born both blind and deaf, and of course deriving all its knowledge of external objects from the senses of touch, taste, and smell †; which senses were in that unfortunate child remarkably acute.

* Vid. Mr Ware's excellent account of the Purulent Ophthalmy of Children.

† Vid. Mr Dugald Stewart's Account of a Boy, born Blind and Deaf. Trans. of R. S. Edin. vol. vii.

Some children are born deaf from the meatus auditorius externus being awanting.

The frænum linguæ is sometimes too short, or it is attached to the tongue too far forwards, and sometimes it is too long.

In these cases, the child cannot suck well, nor can it in after life speak distinctly.

Purple patches are often observed on the skin of children at birth.

They are of two kinds; the first may be called *blemishes of a red colour*, and are not elevated; the second is of a dark purple colour, largely supplied with bloodvessels, and occasionally discharge blood.

SECT. III.

OF MALCONFORMATION OF THE HEART.

DEVIATIONS from the natural structure of the heart of very different descriptions sometimes occur.

The 1st, and most frequent, is that in which the foramen ovale remains open, by which the venous and arterial blood are mixed.

2d, The foramen ovale and ductus arteriosus, in a few cases continue open.

3d, In a few cases, the ventricles of the heart communicate with each other.

4th, The aorta sometimes takes its rise from both ventricles of the heart.

The 5th kind of malconformation is extremely rare; in this, the pulmonary artery is impervious at its origin, and but a small quantity of blood flows into it by a retrograde action of the canalis arteriosus; which, to make use of the language of Dr Wm. Hunter, who has described this malconformation, instead of going backward as a continuation of the trunk of the pulmonary artery, it began from the left branch of that artery, rising upwards and forwards to its termination in the curvature of the aorta, nearly under or opposite to the left subclavian; it had carried the blood from the aorta to the pulmonary artery, and therefore took the appearance of a branch of the aorta, rather than that of the pulmonary artery.

Upon opening the right ventricle, it appeared to be almost solid flesh, and hardly any of the cavity remained open. It was therefore very plain, that there had been no circulation of blood through the right ventricle. The returning blood of both cavæ, had passed through the foramen ovale and left ventricle into the aorta, from which, by the canalis arteriosus, a small portion had been conveyed by a retrograde motion into the left branch of the pulmonary artery, and thence, no doubt, through the whole, to receive the benefit of respiration.

This species of malconformation, is still more unfrequent than the preceding, and has only been

described by Mr WILSON, teacher of anatomy in London *.

The heart resembled that of an amphibious animal, and consisted only of one auricle and one ventricle; and, from the latter, a large artery was derived, which ascended into the chest, where it divided into two branches; the one of which, was bent like the arch of the aorta, and the other was distributed upon the lungs; and from the lungs, the blood was returned by two veins which joined the vena cava superior, and entered the heart along with it.

The last species of malconformation, is that in which the mitral valve is imperfect, leaving merely a small opening between the left auricle and ventricle. This kind of malconformation has been particularly described by Mr ALLAN BURNS. He has observed, " I have only seen three cases of this kind, in two of them, the mitral valve, instead of being formed of two flaps, presented only the appearance of a septum, stretching across the opening from the auricle into the ventricle, having in the centre an aperture of larger or smaller size, through which the blood passed from the one cavity into the other †."

* Phil. Trans.

† BURNS, on the Diseases of the Heart.

SECT. IV.

OF IMPERFECTIONS AS TO THE FORMATION OF THE ALIMENTARY CANAL.

IMPERFECTIONS of the Alimentary Canal, are not unfrequent.

A preternatural membrane sometimes extends across the mouth.

Imperfections of a part of the intestinal canal are not uncommon, and especially those of the intestinum, commonly named *rectum*.

The first and most common malconformation, is that in which the rectum is covered by the common teguments, or by a membrane of considerable thickness.

In some such cases, a swelling is perceptible, where the rectum should form the anus, which feels soft when pressed; and on plunging a lancet into the prominent tumour, the meconium is discharged.

This unnatural membrane is sometimes so thin, that the colour of the meconium shining through it is distinguishable; but sometimes it is hard and thick, with a livid mark in its centre.

There is a variety of this malconformation mentioned by Dr WRISBERG, in which the rectum terminated in a kind of cul de sac.

In the second species, the membrane which obstructs the rectum, instead of being situated externally, is internal, and may be felt by introducing the finger into the rectum, especially when the child cries, as it yields to the impulse of the liquid meconium contained within the rectum.

This membrane is in some examples thin, but in others of considerable thickness; and has been said by TRIOEN *, to be in some instances as hard as horn.

This cause of obstruction cannot in all instances be removed; as though a perforation be made through the obstructing membrane, the rectum remains constricted.

The third species of malconformation, is by no means so frequent as the first, as it proceeds from the unnatural contraction of the rectum.

I have seen the rectum contracted to one-third of its natural diameter, so that the meconium passed with great difficulty through it, or not at all; and the child dies in consequence of the accumulation of the excrement within the intestines.

This malconformation may in some cases be removed, by dilating the contracted rectum by a bougie; and it is necessary to use the bougie for a considerable time, lest the contraction should not be completely removed, or should return.

* Vid. Obs. Med. Chir. p. 60.

In some cases, the rectum has been completely obliterated, and its opposite sides have been united.

In some such cases, the anus seems exteriorly well formed, but in others there is no appearance of an anus.

JESSEN has related a very marked case of the above description. A girl was born with the anus well formed exteriorly. On introducing a probe into the opening, a great resistance was felt. A puncture was made, which did not procure an evacuation of the meconium.

The child died sixteen days after its birth. On opening the body, we are informed, "Rectum intestinum bis lateribus concreverat, bis orbiculari intersepiebatur membrana *."

In the fourth species, the rectum terminates in the bladder of urine, urethra, vagina, or womb, or sometimes there is one opening into the bladder, and another into the vagina.

In the Museum of Edinburgh, there are three instances of this description, which proved fatal to the children in a few days; the rectum, which was so much contracted as to prevent the free passage to the meconium, opened into the lower part of the bladder.

But in a case related by FLAJANI *, a child with such a malconformation lived for three

* Vid. SCHENCKII, Obs. Med. Lib. iii.

† Vid. FLAJANI, Observ. de Chirurg. tom. iv.

months, during which the meconium was voided along with the urine.

On opening the body, the colon, and the greater part of the intestines, appeared very much distended, and filled with solid excrements. The rectum was three inches in length, and ended in a canal four inches long, which passed under the prostate gland, and opened into the membranous part of the urethra. At the place of the insertion of the canal, there was a cherry-stone, which the child had swallowed, and which had prevented the passage of the excrement through the urethra.

Fifth, The rectum, in a few very rare cases, has terminated in the vagina, and the fæces are discharged by the vagina.

The opening into the vagina is commonly so much contracted, that the child lives only for a few days, on account of the retention of the fæces. But some have lived for some years.

Van Swieten * has related the history of a young woman, who had such a malconformation.

Benivenius † has described the case of a woman, who discharged her fæces by the vagina for sixteen years.

* Vid. Comment. in Boerhaave, Aph. 1340.

† Vid. Obs. Med. cap. 86.

Sixth, The rectum is sometimes entirely awanting, and the colon is closed at its lower extremity, and ends in a blind sac *.

In some such cases, we observe a mark of anus, but in others no anus.

In some cases, the intestines open upon some part of the parietes of the abdomen, and sometimes at the navel.

MERY has described a case, in which there was an aperture at the navel, in which the colon terminated †.

Cases have been described by LITTRE and PETIT, where the colon and rectum were wanting: It has been proposed in this case by VAN SWIETEN, where an attempt to form an artificial anus has failed, to open the abdomen, in order to procure a passage for the fæces. But much danger must attend such an operation ; besides the surgeon is without a guide to direct him.

Sometimes the colon ends in a kind of blind sac, about an inch from the rectum, and the rectum sometimes also forms a blind sac, which is quite distinct, and unconnected with the colon.

A case of this kind has been related in the first volume of the Memoirs of the Academy of Surgery, in which the patient was cured by the introduction

* Vid. RUYSCH, Adver. Anat. decad. ii. p. 45. ; also JAMIESON, Edinb. Med. Essays, vol. iv.

† Vid. Hist. de l'Acad. des Scien. an 1700, p. 40.

of a trocar, which reached the place in which the meconium had been accumulated.

LIEUTAUD has described a case, where the rectum was entirely wanting, and in which the extremity of the colon was much contracted, and as if bound by a cord.

Seventh, Mr DE LA FAYE * has described two cases in which the anus was not shut up; there was an opening in the middle of the os sacrum, which was capable of admitting the finger. In one of the children, a portion of the intestines passed through this opening, and formed a kind of hernia.

Eighth, There is still another malconformation which has been thus described by Mr BURNS †. "The rectum, instead of terminating at the usual place, perforated the posterior wall of the vagina; then, occupying the canal of the vagina, it passed through the vulva, and projected about an inch beyond the labia pudendi, bearing a distinct resemblance to an imperfectly formed penis. It was of considerable size, possessing a writhing motion, and freely discharging meconium by an orifice situated at its apex."

* Vid. his Principes de Chirurg.

† Vid. Edinb. Med. and Surg. Journal, vol. i. p. 137.

SECT. V.

OF TRANSPOSITIONS OF THE VISCERA.

TRANSPOSITIONS of the Viscera are by no means frequent.

The heart is sometimes situated on the right side of the body.

The spleen, and sigmoid flexure of the colon, are sometimes placed on the right side, and the caput cæcum coli on the left side.

SECT. VI.

OF THE ORGANIC DISEASES OF CHILDREN.

CHILDREN, soon after birth, are subject to several of the cutaneous diseases which have been already described, particularly to the red and yellow gum, to aphthæ, to excoriations behind the ears, and sometimes to erysipelas.

The fœtus in utero, is sometimes affected with the lues venerea, and sometimes with small-pox.

The lues venerea may be communicated to the child while it is passing through the vagina of a

woman who has chancres, or by sucking a woman whose breasts are diseased.

Hydrocephalus may be enumerated among the diseases of the fœtus in utero: the child is born with a large head, and in many cases dies, after making a few convulsive inspirations; but there are others who have lived many years with this disease, and the head gradually attains a larger and larger size, until it measures perhaps thirty-five or forty inches round.

The brain of children cut off by this kind of hydrocephalus, bears a strong resemblance to a bag filled with water, and the water is remarkably limpid and transparent, and contains much less albumen than the water accumulated in cases of dropsy within the chest, belly, or within the vaginal coat of the testis.

The substance of the brain is in some cases not above half an inch in thickness; and when the whole brain and cerebellum have been removed, these are found to have lost a half or two-thirds of their weight.

But when the disease comes on a few years after birth, it generally proves fatal in six or eight weeks, and the brain exhibits a very different appearance. It commonly looks as if it had been steeped in water, is not much lighter than in the healthy state, and its ventricles contain generally from a quarter of an ounce to four or five ounces of clear watery fluid.

Of Organic Diseases of the Larynx, Trachea and Lungs.

Children are frequently afflicted by the croup, and also by inflammation in the smaller branches of the windpipe; which organic diseases have been already described.

Diseases of the Intestinal Canal.

Children are extremely subject to organic diseases of the intestines, particularly to inflammation and intus-susceptio.

Many children have worms, either the ascarides or lumbrici, for the tape-worm is rarely observed before the child is seven or eight years old.

Organic Derangements of the Liver.

The inflammation and enlargement of the liver, may be enumerated among the organic diseases of infancy and childhood, and they very frequently prove fatal.

This inflammation of the liver, is sometimes succeeded by suppuration.

The liver in children sometimes attains a very large size, and descends as low down as the navel;

in colour it resembles cream, is uniform in consistence, rather softer than usual, and more easily torn, and the vessels on the peritoneal coat are in many such cases distended with blood.

The neighbouring lymphatic glands are generally reduced to a morbid state, and very much enlarged, and particularly those situated in the capsule of Glisson.

The passage through which the testes pass within the scrotum, sometimes remains open, or is only partially shut, hence boys are exposed to the congenital hernia.

Of the Congenital Hernia of the Male.

The name implies, that the disease shews itself at, or soon after birth; but this name is exceptionable, as it gives an incorrect idea of the nature of this disease, which is much more frequent a short time after, than at the time of birth, and sometimes shews itself during manhood. This kind of hernia, therefore, should be called the *vaginal*, instead of the congenital hernia; and it is necessary to add, "of the male," to distinguish from the vaginal hernia of the female; as the protruded bowels are in immediate contact with the testicle, owing to the passage through which the testes had passed, remaining open.

In this hernia, the displaced bowels are situated within the canal, through which the testes pass from the abdomen into the scrotum, which, though commonly obliterated, sometimes remains open during the whole of life.

The nature of this kind of hernia was long unknown. We are chiefly indebted to Baron HALLER, WRISBERG, Mr POTT, and to Dr and Mr J. HUNTER, for our knowledge on this head.

There is much irregularity as to the period at which the canal, through which the testes pass, is obliterated.

Dr CAMPER has published the following observations on the subject; he examined for that purpose the bodies of seventeen new-born male children. In eleven, the canal was open on both sides; in three, a portion on the right side was open; and in two, a portion on the left side was open; and in one only, the canal was obliterated on both sides.

Professor WRISBERG also has published many valuable observations on the descent of the testes, to which I beg leave to refer the reader *.

There is frequently a stricture in the middle of the canal through which the testes pass.

In a case of this description, which I dissected, there was a stricture in the middle of the canal, and a part of the omentum had got beyond the

* Vid. Comment. Soc. Reg. Scient. Gotting.

constricted part of the canal, and had attained an unnatural bulk.

The canal for the testes has been sometimes observed to be contracted at its upper, and also in its under parts, and sometimes, according to Dr Wrisberg, in two different places at the same time.

Sometimes the testicles are detained in the groin, and have been mistaken for an inguinal hernia, and upon that supposition, trusses have been worn.

The size and figure of this hernia is various, and depends upon the situation of the stricture in the canal; should the stricture be seated near to the under part of the scrotum, the hernial tumour then assumes an oblong figure, and is equally large in its upper, as in its under part, and the tumour passes out perpendicularly from the abdomen; because, in a child at birth, the spermatic cord does *not pass obliquely through the parietes of the abdomen*, as in the adult, but passes directly through these, and hence the peculiar shape of the herniary tumour.

Lobstein has described a case of congenital hernia, in which the tumour descended as low as the knee.

The sac of the congenital hernia sometimes acquires a preternatural thickness, sometimes it is of an unusual thinness. Mr Arnaud relates a case, where the sac was so thin, that he divided it, in

making the incision through the skin, and with difficulty could find it out afterwards.

The sac, which is of an oblong figure, is covered by the cremaster muscle, and the thin fascia of the abdominal muscles.

On account of the greater shortness of the omentum of children, that organ is seldom contained within the hernial sac.

As life advances, in consequence of the omentum being elongated, it gets into the hernial sac, which originally contained only a portion of the small intestine.

Mr A. Burns communicated to me a case, which forms an exception to the above observation. He met with an instance in a new-born child, of the omentum, which had previously adhered to the testicle, being dragged from the abdomen, along with that organ.

It sometimes happens, as in a case related by Mery, in the Academy of Sciences at Paris, 1701, that the omentum, which had been displaced, has involved the testicle, which led the surgeon to suppose, that the patient was afflicted by a sarcocele. Meckel relates another effect of adhesion between the omentum and testicle.

If the testicle, before it has reached the scrotum, contracts an adhesion with the other viscera of the abdomen, it may retard, or may prevent the descent of the intestines.

Wrisberg has described several cases, in which the patients afflicted by this variety of hernia,

which was reducible, suffered the most excruciating pain whenever the hernia was reduced, which was found to have originated from a preternatural adhesion between the testicle and the omentum.

Dr WRISBERG, and Mr POTT, also make mention of the intimate connection between the protruded bowels, and the testicle, and also of the difficulty of disuniting them.

When the testicle has descended no lower than the UNDER ABDOMINAL APERTURE, it sometimes happens, that the intestine slips past it into the scrotum.

Mr POTT met with two such cases; the patients could not wear a bandage, on account of its pressure on the testicle. Sometimes the testicle in the groin has proved a cause of strangulation.

This species of hernia may generally be distinguished from the scrotal, from the difficulty of distinguishing the testicle, which is involved by the protruded parts.

It may not be improper to add a circumstance respecting congenital hernia, which was lately communicated to me.

About four years ago, a Surgeon was desired to reduce a congenital hernia in a boy of six years old; he did so, and along with the bowels, he pushed back the testicle into the abdomen, which has never since passed into the scrotum.

It sometimes happens, that the congenital hernia is complicated with a hydrocele. In that par-

ticular case, the water collected within the vaginal coat, by change of posture, readily returns into the cavity of the abdomen.

Of the varieties of Congenital Hernia.

Mr HEY *, and Mr FOSTER †, have described an unusual variety of congenital hernia, in which the protruded bowels, with their containing sac, were included within the tunica vaginalis testis.

This kind of hernia was probably occasioned by the canal, through which the testes pass, being shut in its upper part, whilst its lower part remained open.

Of Congenital Hernia of the Female.

In the observations on crural hernia which I formerly published, I observed, that infants of the female sex may be afflicted by hernia congenita, as there is a canal formed by the peritoneum, which passes through the UNDER ABDOMINAL APERTURE, over the round ligament of the uterus. This canal is about half an inch in length, and terminates in a blind sac at the groin.

* Vid. his Practical Observations.

† Vid. Mr ASTLEY COOPER's book on Hernia, Part I. p. 59.

NUCK * is the first author who has described this canal; he called it a *diverticulum*. Some authors had entertained doubts upon this point of anatomy, until CAMPER † and WRISBERG ‡ examined the subject with attention.

CAMPER found the above-mentioned canal open in three of fourteen female infants after birth; and adds, that he had discovered traces of it in women after delivery.

WRISBERG observed the canal of different sizes, and open in nineteen out of two hundred children.

LE CAT observed it in a woman of forty-six years of age, of the size of a goose-quill.

Mr A. BURNS, in two cases of ascites, found this canal so much enlarged, as to admit of the introduction of the thumb.

I have subjoined a letter, which I received from Mr A. BURNS of Glasgow, descriptive of the congenital hernia of the female.

"I have now examined seven cases of this kind, and in six have found the anterior side of the inguinal canal deficient. The instance in which I found this species of herniary sac not conjoined with imperfect formation of the inguinal canal, was in a girl aged thirteen years. Although I have once met with a congenital hernia without deficiency of

* Vid. Adenographia Curiosa, cap. 10.

† Haarlem Trans.

‡ WRISBERG, de Test. descens.

the anterior side of the canal, yet I have never had occasion to notice any case in which this deficiency existed, and was not complicated with congenital hernia.

"In one of the subjects with congenital hernia, the sac did not escape from the canal; in five, it had, from the peculiar state of the canal, descended along the thigh, assuming to a great degree the resemblance of crural hernia; and in one, it was bound down by the superficial aponeurosis of the external oblique. In this person, the oblique aponeurosis had come in reality to supply the place of the anterior side of the canal; it was so strong, that it resisted the passage of the tumour down along the thigh; it led it down to the upper part of the labium pudendi.

"This was not the only peculiarity of the case; for the tumour, in its course to the labium, insinuated itself between the fillets of the upper pillar of the canal, and at that point was strictured by this fillet. There was also a very obvious narrowing at the part where the sac escaped from the deficient canal. The stricture was formed by the interlacing fibres of the external oblique; a fact which proves, that the deficiency of the canal does not depend on the want of these fibres.

"In congenital inguinal hernia, the risk is, that we mistake the disease for crural hernia. It has been seen, that the tumour in the former, owing to the imperfect state of the anterior wall of the canal, comes, in the majority of cases, by separating the

fibres of the oblique aponeurosis, to place itself, in so far as regards the course of the swelling, in the situation of a crural hernia."

There are many examples within my knowledge, where this mistake was never discovered till after the operation had been performed. Generally, it is unpardonable in a surgeon to confound the one disease with the other.

He can never, indeed, be excusable, unless where the parts around the sac are so swelled and diseased, that there is no possibility of distinguishing Poupart's ligament.

In congenital inguinal hernia in the female, I have found that the tumour, when it descended along the thigh, lay above the adipo-glandular fascia, so that it was more defined and superficial than in crural hernia. I may add, that in the case from which the annexed Plate was taken, no one could, previous to the exposure of the parts by dissection, have conjectured that the anterior side of the canal was so extensively wanting. This arose from the unusual resistance afforded by the oblique aponeurosis; a resistance which prevented the descent of the sac along the thigh.

Where the deficiency of the canal was great, and the hernia large and reducible, I have found that the finger could be made to follow the bowels, and so could be turned into the crural foramen.

Infants are frequently afflicted by umbilical hernia.

There is a variety of this kind of hernia, which is congenite. The navel-string ends in a bag, which appears to be formed by the extension of the cord. This bag, which is so thin, that its contents are perceived, contains a portion of the bowels of the abdomen, and it communicates by an aperture in the situation of the navel with the cavity of the abdomen *.

I have seen this kind of rupture of great size, and containing the liver and stomach.

SECT. VII.

OF SHRIVELLED FOETUSES.

THE last circumstance regarding the fœtus which merits mention, is, that the fœtus sometimes shrivels, but does not putrefy; and such shrivelled fœtus is sometimes discharged, after a full-grown healthy child.

There is a specimen of the above description in the Museum of the University. A fœtus, about eight inches long, and remarkably thin, and which seemed as if it had been compressed by a heavy weight, came away after a full-grown and healthy child.

* Vid. HEY's Surgery; also Dr HAMILTON's Observations on this kind of Umbilical Hernia, in Mr ASTLEY COOPER's Book on Hernia. Also ALBINI, Anat. Acad. lib. i.; RUYSCH, Obs. Anat. Chir. Obs. p. 71.

PART XXIV.

CHAPTER I.

OF THE ORGANIC DISEASES OF PREGNANT WOMEN.

PREGNANT women are subject to the piles, to jaundice, to dropsy of the belly, to umbilical hernia, to rupture or displacement of the womb, and very frequently varix of the veins of one of the limbs.

The uterus, during the fourth month of pregnancy, is sometimes displaced, or, to use the technical language, *retroverted*, by which is meant, that the fundus uteri is thrown backwards and downwards, while the os uteri is directed upwards.

This displacement is said in some instances to take place slowly.

Of the Diseases subsequent to Pregnancy.

One of the most frequent organic diseases subsequent to pregnancy, is peritoneal inflammation

After delivery, inversion of the uterus sometimes takes place, in different degrees; when the inversion is slight, the tumour is retained within the vagina, and the fundus uteri protrudes only to a certain degree through the mouth of the uterus; when, on the other hand, the inversion has been complete, the vagina is also partly inverted, and a tumour of considerable length appears externally.

The inversion of the uterus is sometimes followed by a profuse bleeding; by convulsions, or syncope; or it induces distention or inflammation of the bladder, by its pressure on the urethra; or sometimes occasions a discharge of fetid matter, which is succeeded by a lingering hectic fever.

Of Ruptured Uterus.

Any part of the womb may be ruptured. I believe the rupture of the neck of the womb to be more common than that of any other part of that organ.

Rupture of the womb has been stated by Drs Percival and Underwood to be the consequence of a fright; it may be owing to external violence; and, according to Lieutaud, it is sometimes the effect of the placenta plugging up the mouth of the womb.

When the uterus has been ruptured, the patient generally dies, as in a case I examined, from loss of blood.

But there have been instances in which the fœtus has been lodged for years within the cavity of the abdomen, and where the uterus has decreased in size, and the woman has enjoyed pretty good health for some years afterwards.

Of Extra-Uterine Fœtuses.

Fœtuses have been found in the ovaria *, or in the uterine tube, enveloped in its membranes, the amnion and chorion.

The tube, containing the fœtus, sometimes adheres to the peritoneum, or to the intestines; and, after some months, the sac bursts externally, and a great deal of fetid matter is discharged along with coagulated blood, and pieces of bone.

The uterine tube, containing the fœtus, sometimes adheres to the parietes of the abdomen †, or to the intestines; and after a time, symptoms of violent irritation and inflammation come on,

* Vid. LITTRE, Acad. des Sciences, 1701;—also HALLER Element. Phys. vol. viii.

† Vid. ALBUCASIS, lib. ii. c. 76.

succeeded by hectic fever. The sac, containing the fœtus, bursts generally about the third month of pregnancy; a great deal of fetid matter, and coagulated blood, and sometimes bones, are discharged by the rectum *, vagina †, or bladder ‡. In some cases, even an entire fœtus has been discharged from the navel §, or by the rectum ‖.

But in some cases the extra-uterine fœtus remains for years within the abdomen, without giving rise to any peculiar symptoms. There is a case in the Museum of the University, in which a fœtus, which was in part covered by a shell of bone, remained within the abdomen for thirty-four years.

The patient had been in labour for twelve days, after which the labour-pains entirely went off. Nothing had been discharged. The patient carried the mass for thirty-four years. After death, it was cut out by Mr Logan, surgeon in Ayrshire.

* Vid. Pouteau, Melang. p. 373.;—also Winthrop, Phil. Trans. 43.

† Vid. Smith, Med. Comment. vol. v.; Med. and Phys. Journ. vol. ii.; Camper, Demons. Anat. Pathol. lib. 2.

‡ Vid. Ronseus, Epist. Med. Recueil Period. tom. 13. Med. and Phys. Journal, vol. xiv. p. 425.

§ Vid. Lond. Med. Obs. & Inq. vol. ii. p. 369.

‖ Vid. Gifford, Phil. Trans. vol. xxxvi. p. 425.

Another case, which is somewhat similar, is preserved in the Museum. The fœtus had lain only for three years within the cavity of the abdomen, when it was cut out by Mr ROBERTSON, surgeon in Jamaica, *and the operation did not prove fatal to the patient*.

In a few rare cases, the extra-uterine fœtus has fallen downwards between the rectum and vagina, and has occasioned the same symptoms as the retroversio uteri.

There are also cases upon record, in which the placenta has adhered to the stomach or the colon, or even to the spine*.

Two cases have lately occurred, in which fœtuses were contained within the abdomen of the male †.

* Vid. MORGAGNI, Epist. lviii.
DUVERNY, Oeuvres Posthum. tom. ii. p. 362.
Also MAURICEAU, Traité des Malad. des Femmes grosses.
DIONIS, Operat. Chir. art. Operat. Cæsar.
TH. BARTHOLIN. de insolitis Partubus.

† Vid. RICHERAND'S Physiology, translated by Dr DE LYS, p. 496.; and,
YOUNG, Medico-Chirurg. Transact. of London, vol. i.

CHAPTER II.

OF THE ORGANIC DERANGEMENTS OF THE PLACENTA.

The Placenta sometimes is much softer than natural; tumours form in its substance, or it is partly ossified.

Of Ossification in the Placenta.

This substance is sometimes in part ossified. I have met with three cases of this description; the patients were young healthy women.

The placenta, in all the cases, adhered rather more firmly to the fundus uteri than common. The children were very thin, but very healthy in every respect, and sucked readily when put to the breast.

Upon examining the placenta, I observed that the largest pieces of bone were found immediately under the membranes covering it.

Many of the pieces of bone were attached to the outer side of the branches of the arteries of that organ, by means of very small threads, which were probably hollow vessels.

One of the patients from whom the ossified placenta had been extracted, fell again with child. Every thing went on during the period of utero-gestation in the common manner, and the placenta was found nearly in the same state as before. Nearly two years intervened between the births.

Of the Degeneration of the Placenta into Hydatids.

The Placenta, in some cases, is converted into a mass of hydatids of different sizes, which adhere to each other, so that it somewhat resembles a bunch of grapes.

LIST OF AUTHORS ON THE GRAVID WOMB, AND ON THE STRUCTURE OF THE FOETUS.

Authors on the Gravid Womb.

Adolp. Bochmeri, Obs. Anat. circa Uterum Human.

Roederer, de Utero. Gottingæ, 1759.

Dr W. Hunter's Plates of the Gravid Uterus.

Hunter's Anatomical Description of the Gravid Uterus, published by Dr Baillie.

Dr Denman's Midwifery.

Baudelocques Midwifery,—4th edit.

Authors on the Peculiarities of the Foetus.

Wrisberg, Descrip. Anat. Embry. Gött. 1764.

Roederer, de Pondere et Longitudine infantum recens natorum.

C. L. Trew, de differentiis Hominis nati et non nati. Altdorf, 1736.

J. G. Roederer, de Fœtu perfecto. Strasburg, 1750.

Lobstein, Diss. sur la Nutrition du Fœtus. Strasburg, 1802.

Haller, Program. Herniar. Obs. Gœtting. 1749.

Lobstein, de Hernia Congenita.

Wrisberg, Observ. Anat. de Testicul. ex abd. descen. vol. i. Wrisberg, Comment., and in the Commentat. Soc. Reg. Scient. Gœtting. 1778.

Camperi Icones Herniar. Tab. x. & xi.

J. Hunter, on the Descent of the Testicle.

Lawrence, on Hernia.

For an account of the manner of formation and peculiarities of the Inguinal Canal of the Fœtus,—see vol. ii,

Engravings of the Fœtus.

Th. Soemmering, Icones, Embryon Human. Francofurti ad Mœnum, 1799.

Dr W. Hunter, on the Gravid Uterus.

In Fyfe's System of Anatomy, the figures of Soemmering, representing the size of the Fœtus at different ages, have been very faithfully copied; and, in the same book, there are several useful plates, representing the peculiarities of the viscera of the fœtus, as also the structure of the foramen ovale, or passage between the auricles of the heart.

CONCLUSION.

In superintending these Outlines, while passing through the Press, I have paid a willing attention to a judicious remark of Condillac, that what has been once said, and in its proper place, is more clear to a careful reader, than if it were frequently repeated.

Another consideration, which some anatomists have been blamed for overlooking, has been habitually present to my thoughts. Hence I have scrupulously avoided, as far as it has been in my power, the error of dividing the body into parts, and of describing separately the bones, muscles, bowels, arteries, veins and nerves, without adverting to their combination, mutual relation and action in the living structure.

The practice, against which I have been solicitous to guard, has a necessary tendency to keep out of view the relations which the different parts of the system bear to one another, and their subserviency to the important functions for which they are ultimately designed.

In treating of the parts, therefore, in the progress of the Lectures, while due attention is be-

stowed on accuracy and minuteness of description, it is my anxious wish to keep the mind of the student continually awake to their relative position and intimate connection.

On this principle, I have not neglected to note, even in the Outlines, that the form and movements of the ribs have a reference to the lungs, and the function of respiration; that the structure of the pelvis or basin, has a reference to the functions of the bladder of urine, and of the womb; and that the structure of the skull contributes to the acuteness of the organs of sense.

Room has also been made for remarks of the following character,—that an exact knowledge of the relative situation of the bones, muscles, arteries, veins, and nerves, is indispensably necessary to every operation which the surgeon can be called upon to perform, and ought to have a due influence on all the steps which he may be induced to take in preparing for the relief of accident or disease. These are hints of equal importance for directing the prosecution of study, and the details of successful practice.

The exposition contained in these Volumes of the Winter Course of Anatomy, taught in the University of Edinburgh, may perhaps serve to convince the public of a fact, well known to my pupils, that the Morbid Anatomy is not detached from the healthy, and converted into the business of a Summer Session.

It never escaped my thoughts for a moment, that the healthy anatomy is cultivated chiefly to assist the medical practitioner in ministering to the ailments and distresses of mankind, and that this application constitutes the professional value of the science, and its subserviency to the duties of a useful art. The Summer Course, lately instituted, takes nothing from that delivered in the winter, which the progress of knowledge had led me to superadd to it, but was intended solely for the purpose of prosecuting at greater length a particular branch of the general subject which has many strong claims to accurate and minute investigation.

While these Outlines bear witness to the nature and extent of the subjects discussed in the Anatomical Chair, I am not unwilling to hope, that they may be of considerable practical utility to the Students for whose benefit they have been designed, by apprizing them of the articles to be brought under their review; by suggesting the books which it may be proper to consult, in order to prepare them for entering fully into the detail of facts and illustrations; and by serving afterwards as the notes of an artificial memory, to bring their knowledge readily to their recollection.

THE END.

APPENDIX.

Explanation of the Plates of Urinary Concretions, together with Observations on the Chemical Ingredients of these by Mr John Davy.

[The Plates 37. 38. and 38 A, represent almost all the varieties as to the size, figure, and chemical composition of urinary concretions, which are occasionally met with in the urinary passages. As these Plates were not finished when the text to which they refer was printed, I was under the necessity of throwing the Explanation of them, written by Mr John Davy, into the form of an Appendix.]

Explanation of Plate XXXVII.

" Fig. 1.—From a section of it, this calculus seems to be of a uniform composition. It consists of very small brilliant crystals, but slightly compacted together, and is in consequence very frangible. Uric acid, and extractive matter, are its chief constituent parts: It contains, besides, a very small quantity of phosphat of lime, about 1 per cent.

" The characteristic chemical properties of this kind of calculus are the following. It is very little acted on by muriatic acid. Nitric acid dissolves it readily, and the solution evaporated affords a fine pink-coloured residue. It is partially dissolved by a caustic solution of potash or soda, and partially by water. The alkali takes up the uric acid, and the water the extractive matter. Before the blow-pipe, it inflames; emits a strong ammoniacal odour, and almost entirely consumes; leaving only a very little fixed ash, which is generally phosphat of lime or magnesia, or oxalat of lime, or mixtures of these salts. Heated in a close vessel, it affords, besides different gases, water, sub-carbonat of ammonia, and a yellow bitter oil, of a butyraceous consistence. This is the most common species of urinary calculus.

"FIG. 2.—represents a calculus from the kidney. The figure was taken before a section had been made of it. When divided, it was found to be composed of two kinds of matter. The whole exterior chiefly consists of uric acid. It only differs from the preceding in physical properties, being harder, more compact, and not apparently crystalline. The nucleus which the section exhibited, is of a nut-brown colour, and consists of concentric layers, thin, hard, and brittle. This nucleus is principally composed of uric acid, of oxalat of lime, and phosphat of lime.

"FIG. 3.—represents a uric calculus containing a little extractive matter, and about 4 per cent. of mixed phosphat and oxalat of lime. It is a congeries of very small crystals.

"FIG. 4.—represents a calculus, the chemical qualities of which are very similar to those of the last, and the proportions of the constituent parts much the same. The texture is different externally, the fracture is earthy, and internally resinous.

"FIG. 5.—represents a calculus taken from the bladder of urine. It is remarkably hard and brittle. On its exterior surface, as the figure exhibits, there is the appearance of a crystalline arrangement in the form of cubes. The calculus consists of concentric coats very slightly adhering to-

gether, and very easily detached or broken from each other. The internal layers only differ from the external surface, in being of a lighter colour, and of a less crystalline texture. It is composed of phosphat of lime and water, without any appreciable quantity of animal matter. It possesses the following chemical properties:

"It neither decrepitates nor burns before the blow-pipe, but fuses when strongly heated. It readily dissolves, without effervescence, and without affording any sensible residue, in the muriatic and the nitric acids. The whole taken up by these acids, is thrown down by ammonia, and the precipitated matter is quite insoluble in oxalic acid. The calculus, heated to redness in a glass tube, yields as much as 20 per cent. of water, and nothing else besides the fixed phosphat of lime. This, I believe, is a new fact. I am not aware, that water ever before has been found combined with phosphat of lime. It is a true hydrophosphat, and I have formed artificially a similar one, though with a smaller proportion of water.

"Fig. 6.—represents a calculus consisting chiefly of uric acid, with a small quantity of extractive matter, and of earthy salts. It is brittle, and its fracture is resinous."

Fig. 7.—represents a large concretion, which had been imbedded within the pelvis of the kidney.

FIG. 8.—represents a concretion of a yellow colour, which also had occupied the pelvis of the kidney.

FIG. 9.—represents a concretion which had been lodged in the bladder of urine, and which had been impressed by another concretion contained in that organ.

Explanation of Plate XXXVIII.

" FIG. 1.—represents the section of a mulberry calculus, taken from the bladder of urine. It is very hard and tough, and is composed of concentric layers, between which there are dark lines, as if of coagulated blood. The rugged irregular globular form, is peculiar to this species, and is alone sufficient to characterise it. Its constituent parts are chiefly oxalat of lime and uric acid, with a little phosphat of lime. The oxalat of lime is insoluble in water, in alkalies, and only with difficulty in muriatic acid. It is inflammable, and the result of its combustion, is quicklime, or carbonat of lime, according to the degree of heat applied. The mulberry calculus is easily analysed. Potash will dissolve the uric acid, acetic acid will take up the phosphat of lime, and the chief constituent part, the oxalat of lime, will remain undissolved."

Fig. 2.—represents the surface of the same concretion.

" Fig. 3.—represents a calculus taken from the kidney. From a section of it, it appears to be composed of successive layers of whitish and of brownish matter, which is soft, and of an earthy texture. The brown layers are too thin to be individually examined; most probably they are chiefly uric acid. The mixture of the two, principally consists of ammoniaco-magnesian phosphat, uric acid, phosphat of lime, and water. The presence of ammoniaco-magnesian phosphat, is easily ascertained. It is soluble in oxalic acid, as well as in the nitric and muriatic; and by ammonia, it is precipitated from them all, unaltered. It is not inflammable. Heated, it affords water and caustic ammonia, and ammonia is also evolved when it is acted on by either of the fixed alkalies."

Fig. 4.—This figure represents a concretion, which is of a rounded form, and with an uneven surface.

Fig. 5.—represents a concretion taken from the bladder, which was of a very uncommon form, externally white and friable, and internally it contained a concretion of a dark brown colour.

"FIG. 6.—was taken from a cast of a urinary concretion; the smaller end of which had been lodged within the bladder of urine.

"FIGS. 7. & 8.—represent urinary concretions, which had impressed each other so much, as to resemble cup and ball.

Explanation of Plate XXXVIII A.

"FIG. 1. and 2.—Fig. 1. represents the outer surface of the concretion, and fig. 2. a section of it.

"This very large calculus* consists of three kinds of matter, perfectly distinct from each other, and well defined by differences of colour.

* In the records of physic and surgery, there are very few cases in which larger urinary concretions have been found, than the above mentioned, which weighed, before it was dry, thirty-two ounces.

A calculus weighing forty-two ounces, has lately been described in the London Philosoph. Transact.

The following authors have described very large urinary concretions.

C. LANCILOTTUS. Nella Guid. àlla Chimic. Part. iii.

JOH. JACOB. LEIBNIZ, Memorab. Bibliothec. Norimb.

JOH. BAPT. HELMONT, de Lithiasi, cap. iii. § 40. f. 43. p. m. 16.

VERDUC, Traité des Operat. de Chirurg. cap. xi. He has described a concretion within the bladder which weighed 3 lbs. and 3 ounces.

THOM. BARTHOLIN. Hist. Anat. Cent. v. Hist. 57. p. 126.

"The nucleus, as represented in the figure, is of a dark brown colour; it is hard and brittle; its form is globular, and its outline rough and ragged. It is a good example of the mulberry calculus.

"The next substance, that which surrounds the nucleus, is of a nut-brown colour, and very brittle; though not hard, its fracture is resinous, and its lustre is slightly resinous; its general appearance is very similar to that of roll-sulphur; its form is completely oval, and its outline quite equal. It is a perfect specimen of the uric calculus.

"The third substance, the envelope of the whole, is white, soft, tough and fibrous; presenting in its section traces of crystallization, and on its external surface evident crystals. This is an equally good instance of the ammoniaco-magnesian calculus.

"I shall briefly describe the experiments I made to ascertain the composition of the calculus; and I shall commence with the nucleus.

"It did not effervesce, and was only partially dissolved in muriatic acid, and a considerable time was required for the full effect to be produced. Ten grains of it in powder, digested in diluted muriatic acid for two days, were dissolved, with the exception of three grains, which put into a solution of caustic potash, soon disappeared, a few flocculi only remaining. Hence it may be concluded, that these three grains were chiefly uric acid, and the undissolved part was probably extractive mat-

ter. Ammonia was added to the muriatic solution, and the precipitate well washed and dried, weighed 6.4 grs. Heated to redness, it inflamed, and afforded a white earth, which had the caustic taste of quicklime. It was dissolved with effervescence in muriatic acid, and the salt obtained by the evaporation of this solution to dryness was completely redissolved by water,—a proof of the absence of all insoluble phosphats. It may, therefore, be concluded, that the 6.4 grs. were oxalat of lime. To ascertain whether the nucleus contained any water, 10 grs. of it were heated in a bent glass tube; the result was, the production of a quantity equal to a drop or two. From these experiments, the nucleus seems to consist of uric acid, oxalat of lime, and water, in the following proportions per cent.:

30	uric acid.
64	oxalat of lime.
6	water.
100	

"The nut-brown substance exhibited all the charateristic properties of uric acid. Heated before the blow-pipe, it inflamed, emitted an ammoniacal odour, and was almost entirely consumed: The ash that remained from five grains was just visible, and not a quantity nearly sufficient for examination. Another portion of it, heated with nitric acid, acquired the pink colour; and a

third portion, digested in a solution of potash, was, excepting a few flakes that remained, entirely dissolved. These results allow us to conclude, that the nut-brown substance is principally uric acid.

"The white crystalline substance was dissolved by the muriatic acid without effervescence: It did not flame when heated, and became only slightly discoloured; the fixed residue it afforded was fusible, when strongly heated. Ten grains of the white substance in powder, heated to dull redness in a bent glass tube, yielded much water, strongly impregnated with ammonia; the residue was of a slight brownish hue, from the charcoal produced, from an inappreciably minute quantity of animal matter; the residue weighed only 4.8 grs. It did not change the colour of turmeric paper, nor effervesce with oxalic acid, which only partially dissolved it; therefore no oxalat of lime was present. The oxalic solution, separated from the insoluble part by filtration, was precipitated by ammonia. This precipitate, heated to redness, weighed 1.3 grs., and was phosphat of magnesia. The part undissolved in the oxalic acid was oxalat of lime, for it afforded quicklime by calcination. The proportion of this phosphat, would appear equal to 3.5 grains, by deducing the quantity of phosphat of magnesia, from the whole of the fixed residue. Thus, the white envelope, seems to be composed of phosphat of lime, and phosphat

of magnesia, of ammonia, and water, in the following proportions:

35 phosphat of lime.
13 phosphat of magnesia.
52 water and ammonia, and slight traces of animal matter.

100

"It is unusual to meet with a calculus of so great a size, and of such a composition as the present. Its composition is particularly instructive, especially in a therapeutical point of view. As it consists of three different kinds of matter possessed of such opposite qualities, it would have been nearly impossible to have removed it from the bladder by means of chemical agents. Suppose the bladder capable of bearing, uninjured, the action of acid and alkalies, what would be the consequence of the introduction of either? Were an acid injected when the stone was fully formed, it might dissolve the external ammoniaco-magnesian phosphat, which is soluble in the nitric and muriatic acid; but it would not remove any of the uric acid, which is acted upon only by alkalies; on the contrary, it is probable, that the acid would occasion a fresh deposition of uric matter, and reinlargement of the stone. But, suppose an alkali, instead of an acid, was first injected, the worst effect might be produced; and there is good reason to believe, that the deposition of the triple

salt would proceed with increased rapidity. And in all the stages of the formation of this calculus, there would be equal danger and difficulty of treatment. Thus the medicines which dissolve the mulberry calculus, precipitate uric acid, and *vice versa*. From various circumstances, from our knowledge of their composition, and the assemblage of different kinds in one stone ; from the action of acids and alkalies upon calculi, and from the effects which these powerful agents have produced, when given as lithontriptics, it may be concluded, that acids and alkalies are never beneficial, when prescribed with the intention of dissolving a stone already formed, and that alkalies are only serviceable when given as general medicines, to correct acidities,, and to repair the deranged digestive powers. These conclusions were first made by Mr Brande, in an excellent paper, published in the Philosophical Transactions, in which he afforded ample proof of the success of magnesia, given internally, in preventing the formation of uric calculous matter."

Fig. 3.—represents a urinary concretion, which weighed fourteen ounces, and which was extracted from the bladder by the late Mr Alexander Wood.

FIG 4.—represents a small urinary concretion, which was taken from the bladder of urine.

FIG. 5. & 6.—represent urinary concretions from the bladder of urine.

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